APÊNDICE I

I.1 ESQUEMA DE QUATRO PONTOS DE PREISSMANN

A seguir são apresentados os valores dos coeficientes R_1 e R_2, utilizados para as conclusões do item 4.2.2, relativas à análise de estabilidade e acuracidade do método implícito de quatro pontos de *Preissmann*. Os valores foram calculados através das expressões:

$$e^{-\beta_n^I \Delta t} = \left\{ \left[1 - \frac{1}{2} \frac{8\,\theta\,R_c^2 \tan^2(\sigma\Delta x/2) + \Delta t\,k}{1 + 4\theta^2 R_c^2 \tan^2(\sigma\Delta x/2) + \theta\Delta t k} \right]^2 + \right.$$

$$\left. + \left[\frac{1}{2} \frac{\left(16\,R_c^2 \tan^2(\sigma\Delta x/2) - \Delta t^2 k^2\right)^{1/2}}{1 + 4\theta^2 R_c^2 \tan^2(\sigma\Delta x/2) + \theta\Delta t k} \right]^2 \right\}^{1/2}$$

[I.1.1]

$$\tan(\beta_n^R \Delta t) = \pm \frac{\left(16\,R_c^2 \tan^2(\sigma\Delta x/2) - \Delta t^2 k^2\right)^{1/2}}{2 + 8\theta R_c^2 \tan^2(\sigma\Delta x/2)(\theta-1) + \Delta t\,k\,(2\theta-1)}$$

[I.1.2]

$$R_1 = \frac{e^{-\tilde{\beta}_n^I}}{e^{-\beta_n^I}} \qquad R_2 = \frac{\tilde{c}}{c} = \frac{\beta_n^R}{\sigma_n}$$

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.25$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
3	1.5044	2.1044	2.6458	2.9317	2.9824	2.9956	2.9993	2.9998
4	1.2127	1.6125	2.2361	2.8101	2.9483	2.9868	2.9979	2.9995
5	1.1205	1.3902	1.9401	2.6719	2.9046	2.9751	2.9960	2.9990
6	1.0785	1.2710	1.7321	2.5309	2.8536	2.9609	2.9936	2.9984
7	1.0556	1.1993	1.5830	2.3946	2.7970	2.9444	2.9909	2.9977
8	1.0416	1.1528	1.4736	2.2671	2.7363	2.9256	2.9877	2.9969
9	1.0323	1.1209	1.3913	2.1502	2.6729	2.9049	2.9840	2.9960
10	1.0259	1.0981	1.3281	2.0446	2.6080	2.8823	2.9800	2.9950
20	1.0062	1.0246	1.0935	1.4437	2.0207	2.5923	2.9190	2.9790
30	1.0028	1.0110	1.0428	1.2315	1.6527	2.2801	2.8263	2.9530
40	1.0015	1.0062	1.0243	1.1394	1.4397	2.0149	2.7125	2.9180
50	1.0010	1.0039	1.0156	1.0923	1.3116	1.8079	2.5879	2.8750
60	1.0007	1.0027	1.0109	1.0654	1.2305	1.6504	2.4607	2.8254
70	1.0005	1.0020	1.0080	1.0486	1.1764	1.5306	2.3369	2.7706
80	1.0004	1.0015	1.0061	1.0375	1.1390	1.4387	2.2200	2.7118
90	1.0003	1.0012	1.0049	1.0298	1.1121	1.3673	2.1119	2.6503
100	1.0002	1.0010	1.0039	1.0242	1.0921	1.3111	2.0133	2.5873
200	1.0001	1.0002	1.0010	1.0061	1.0242	1.0921	1.4384	2.0131
300	1.0000	1.0001	1.0004	1.0027	1.0109	1.0425	1.2301	1.6497
400	1.0000	1.0001	1.0002	1.0015	1.0061	1.0242	1.1389	1.4384
500	1.0000	1.0000	1.0002	1.0010	1.0039	1.0156	1.0921	1.3110
600	1.0000	1.0000	1.0001	1.0007	1.0027	1.0109	1.0653	1.2301
700	1.0000	1.0000	1.0001	1.0005	1.0020	1.0080	1.0486	1.1762
800	1.0000	1.0000	1.0001	1.0004	1.0015	1.0061	1.0375	1.1388
900	1.0000	1.0000	1.0000	1.0003	1.0012	1.0049	1.0298	1.1120
1000	1.0000	1.0000	1.0000	1.0002	1.0010	1.0039	1.0242	1.0921

ESQUEMA DE PREISSMANN

VALORES DE R1 θ = 0.50 $k\Delta t$=0.00

L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
40	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
70	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
80	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
90	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
200	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
300	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
400	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
500	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
600	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
700	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
800	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
900	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.75$ $k\Delta t = 0.00$

L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333
3	0.6647	0.4752	0.3780	0.3411	0.3353	0.3338	0.3334	0.3334
4	0.8246	0.6202	0.4472	0.3559	0.3392	0.3348	0.3336	0.3334
5	0.8925	0.7193	0.5154	0.3743	0.3443	0.3361	0.3338	0.3334
6	0.9272	0.7868	0.5774	0.3951	0.3504	0.3377	0.3340	0.3335
7	0.9473	0.8338	0.6317	0.4176	0.3575	0.3396	0.3344	0.3336
8	0.9601	0.8674	0.6786	0.4411	0.3655	0.3418	0.3347	0.3337
9	0.9687	0.8921	0.7187	0.4651	0.3741	0.3442	0.3351	0.3338
10	0.9748	0.9107	0.7529	0.4891	0.3834	0.3469	0.3356	0.3339
20	0.9938	0.9760	0.9145	0.6927	0.4949	0.3858	0.3426	0.3357
30	0.9973	0.9892	0.9590	0.8120	0.6051	0.4386	0.3538	0.3386
40	0.9985	0.9939	0.9763	0.8777	0.6946	0.4963	0.3687	0.3427
50	0.9990	0.9961	0.9846	0.9155	0.7624	0.5531	0.3864	0.3478
60	0.9993	0.9973	0.9892	0.9386	0.8127	0.6059	0.4064	0.3539
70	0.9995	0.9980	0.9920	0.9536	0.8500	0.6533	0.4279	0.3609
80	0.9996	0.9985	0.9939	0.9638	0.8780	0.6951	0.4505	0.3688
90	0.9997	0.9988	0.9952	0.9711	0.8992	0.7314	0.4735	0.3773
100	0.9998	0.9990	0.9961	0.9763	0.9156	0.7627	0.4967	0.3865
200	0.9999	0.9998	0.9990	0.9939	0.9763	0.9157	0.6952	0.4968
300	1.0000	0.9999	0.9996	0.9973	0.9892	0.9592	0.8129	0.6062
400	1.0000	0.9999	0.9998	0.9985	0.9939	0.9763	0.8781	0.6952
500	1.0000	1.0000	0.9998	0.9990	0.9961	0.9846	0.9157	0.7628
600	1.0000	1.0000	0.9999	0.9993	0.9973	0.9892	0.9387	0.8129
700	1.0000	1.0000	0.9999	0.9995	0.9980	0.9921	0.9537	0.8502
800	1.0000	1.0000	0.9999	0.9996	0.9985	0.9939	0.9639	0.8781
900	1.0000	1.0000	1.0000	0.9997	0.9988	0.9952	0.9711	0.8993
1000	1.0000	1.0000	1.0000	0.9998	0.9990	0.9961	0.9763	0.9157

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 1.00$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
$L/\Delta x$	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.5000	0.2774	0.1429	0.0576	0.0289	0.0144	0.0058	0.0029
4	0.7071	0.4472	0.2425	0.0995	0.0499	0.0250	0.0100	0.0050
5	0.8090	0.5669	0.3254	0.1364	0.0687	0.0344	0.0138	0.0069
6	0.8660	0.6547	0.3974	0.1707	0.0863	0.0433	0.0173	0.0087
7	0.9010	0.7203	0.4607	0.2033	0.1033	0.0518	0.0208	0.0104
8	0.9239	0.7701	0.5167	0.2347	0.1198	0.0602	0.0241	0.0121
9	0.9397	0.8085	0.5662	0.2649	0.1361	0.0685	0.0275	0.0137
10	0.9511	0.8385	0.6098	0.2942	0.1521	0.0767	0.0308	0.0154
20	0.9877	0.9533	0.8447	0.5339	0.3010	0.1559	0.0630	0.0316
30	0.9945	0.9786	0.9218	0.6893	0.4296	0.2314	0.0947	0.0475
40	0.9969	0.9878	0.9539	0.7858	0.5362	0.3027	0.1260	0.0634
50	0.9980	0.9922	0.9698	0.8464	0.6222	0.3693	0.1570	0.0792
60	0.9986	0.9946	0.9787	0.8857	0.6903	0.4305	0.1874	0.0950
70	0.9990	0.9960	0.9842	0.9122	0.7440	0.4864	0.2173	0.1106
80	0.9992	0.9969	0.9879	0.9307	0.7863	0.5368	0.2467	0.1262
90	0.9994	0.9976	0.9904	0.9441	0.8198	0.5821	0.2753	0.1417
100	0.9995	0.9980	0.9922	0.9540	0.8467	0.6226	0.3032	0.1571
200	0.9999	0.9995	0.9980	0.9879	0.9540	0.8467	0.5370	0.3033
300	0.9999	0.9998	0.9991	0.9946	0.9788	0.9223	0.6906	0.4309
400	1.0000	0.9999	0.9995	0.9969	0.9879	0.9540	0.7864	0.5370
500	1.0000	0.9999	0.9997	0.9980	0.9922	0.9698	0.8467	0.6227
600	1.0000	0.9999	0.9998	0.9986	0.9946	0.9788	0.8859	0.6906
700	1.0000	1.0000	0.9998	0.9990	0.9960	0.9843	0.9123	0.7442
800	1.0000	1.0000	0.9999	0.9992	0.9969	0.9879	0.9308	0.7864
900	1.0000	1.0000	0.9999	0.9994	0.9976	0.9904	0.9441	0.8199
1000	1.0000	1.0000	0.9999	0.9995	0.9980	0.9922	0.9540	0.8467

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.25$ $k\Delta t = 0.10$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
3	1.4679	2.0794	2.6340	2.9292	2.9817	2.9954	2.9993	2.9998
4	1.1695	1.5780	2.2139	2.8034	2.9464	2.9863	2.9978	2.9994
5	1.0747	1.3513	1.9118	2.6609	2.9011	2.9742	2.9958	2.9990
6	1.0314	1.2293	1.6999	2.5159	2.8483	2.9595	2.9934	2.9983
7	1.0076	1.1558	1.5481	2.3761	2.7899	2.9423	2.9905	2.9976
8	0.9931	1.1080	1.4365	2.2456	2.7273	2.9229	2.9872	2.9968
9	0.9835	1.0751	1.3525	2.1262	2.6620	2.9015	2.9835	2.9958
10	0.9768	1.0515	1.2879	2.0183	2.5952	2.8781	2.9793	2.9948
20	0.9565	0.9755	1.0468	1.4060	1.9940	2.5790	2.9160	2.9782
30	0.9528	0.9614	0.9944	1.1889	1.6190	2.2589	2.8202	2.9513
40	0.9516	0.9564	0.9752	1.0941	1.4019	1.9881	2.7027	2.9150
50	0.9510	0.9541	0.9662	1.0456	1.2710	1.7772	2.5745	2.8705
60	0.9507	0.9528	0.9613	1.0178	1.1878	1.6167	2.4439	2.8193
70	0.9507	0.9521	0.9583	1.0004	1.1323	1.4946	2.3170	2.7626
80	0.9508	0.9516	0.9564	0.9889	1.0937	1.4008	2.1974	2.7020
90	0.9509	0.9512	0.9550	0.9809	1.0660	1.3279	2.0870	2.6387
100	0.9510	0.9510	0.9541	0.9751	1.0454	1.2705	1.9864	2.5738
200	0.9512	0.9510	0.9510	0.9564	0.9751	1.0454	1.4006	1.9862
300	0.9512	0.9511	0.9508	0.9528	0.9613	0.9941	1.1874	1.6160
400	0.9512	0.9512	0.9510	0.9516	0.9563	0.9751	1.0936	1.4005
500	0.9512	0.9512	0.9511	0.9510	0.9541	0.9662	1.0454	1.2703
600	0.9512	0.9512	0.9511	0.9507	0.9528	0.9613	1.0176	1.1874
700	0.9512	0.9512	0.9511	0.9507	0.9521	0.9583	1.0003	1.1321
800	0.9512	0.9512	0.9512	0.9508	0.9516	0.9563	0.9889	1.0936
900	0.9512	0.9512	0.9512	0.9509	0.9512	0.9550	0.9809	1.0659
1000	0.9512	0.9512	0.9512	0.9510	0.9510	0.9541	0.9751	1.0454

ESQUEMA DE PREISSMANN

VALORES DE R1 θ = 0.50 $k\Delta t$=0.10

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0.9718	0.9876	0.9962	0.9993	0.9998	1.0000	1.0000	1.0000
4	0.9608	0.9753	0.9900	0.9981	0.9995	0.9999	1.0000	1.0000
5	0.9568	0.9678	0.9841	0.9965	0.9991	0.9998	1.0000	1.0000
6	0.9549	0.9632	0.9788	0.9947	0.9985	0.9996	0.9999	1.0000
7	0.9538	0.9602	0.9744	0.9927	0.9979	0.9995	0.9999	1.0000
8	0.9532	0.9582	0.9708	0.9906	0.9973	0.9993	0.9999	1.0000
9	0.9527	0.9568	0.9678	0.9885	0.9965	0.9991	0.9998	1.0000
10	0.9524	0.9558	0.9654	0.9864	0.9957	0.9988	0.9998	1.0000
20	0.9515	0.9524	0.9555	0.9697	0.9858	0.9955	0.9992	0.9998
30	0.9513	0.9517	0.9532	0.9616	0.9765	0.9908	0.9983	0.9996
40	0.9513	0.9515	0.9523	0.9576	0.9696	0.9857	0.9970	0.9992
50	0.9512	0.9514	0.9519	0.9555	0.9648	0.9808	0.9954	0.9988
60	0.9512	0.9513	0.9517	0.9543	0.9615	0.9765	0.9937	0.9982
70	0.9514	0.9513	0.9516	0.9535	0.9592	0.9727	0.9918	0.9976
80	0.9517	0.9513	0.9515	0.9530	0.9576	0.9696	0.9898	0.9970
90	0.9518	0.9512	0.9514	0.9526	0.9564	0.9669	0.9877	0.9962
100	0.9519	0.9512	0.9514	0.9523	0.9555	0.9648	0.9857	0.9954
200	0.9523	0.9519	0.9512	0.9515	0.9523	0.9555	0.9695	0.9857
300	0.9523	0.9522	0.9516	0.9513	0.9517	0.9532	0.9615	0.9764
400	0.9524	0.9523	0.9519	0.9513	0.9515	0.9523	0.9576	0.9695
500	0.9524	0.9523	0.9521	0.9512	0.9514	0.9519	0.9555	0.9648
600	0.9524	0.9523	0.9522	0.9512	0.9513	0.9517	0.9543	0.9615
700	0.9524	0.9523	0.9522	0.9514	0.9513	0.9516	0.9535	0.9592
800	0.9524	0.9524	0.9523	0.9517	0.9513	0.9515	0.9530	0.9576
900	0.9524	0.9524	0.9523	0.9518	0.9512	0.9514	0.9526	0.9564
1000	0.9524	0.9524	0.9523	0.9519	0.9512	0.9514	0.9523	0.9555

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.75$ $k\Delta t = 0.10$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333
3	0.6487	0.4695	0.3763	0.3408	0.3352	0.3338	0.3334	0.3334
4	0.7960	0.6070	0.4428	0.3550	0.3390	0.3348	0.3336	0.3334
5	0.8572	0.6994	0.5079	0.3727	0.3439	0.3360	0.3338	0.3334
6	0.8881	0.7615	0.5666	0.3928	0.3498	0.3376	0.3340	0.3335
7	0.9060	0.8043	0.6178	0.4144	0.3566	0.3394	0.3343	0.3336
8	0.9173	0.8347	0.6616	0.4369	0.3642	0.3415	0.3347	0.3337
9	0.9249	0.8569	0.6989	0.4598	0.3726	0.3438	0.3350	0.3338
10	0.9302	0.8735	0.7305	0.4828	0.3815	0.3464	0.3355	0.3339
20	0.9469	0.9313	0.8768	0.6747	0.4883	0.3838	0.3422	0.3356
30	0.9499	0.9429	0.9163	0.7845	0.5928	0.4345	0.3531	0.3384
40	0.9510	0.9470	0.9315	0.8439	0.6765	0.4897	0.3673	0.3423
50	0.9515	0.9489	0.9389	0.8777	0.7392	0.5437	0.3844	0.3473
60	0.9518	0.9500	0.9429	0.8983	0.7852	0.5936	0.4036	0.3532
70	0.9521	0.9506	0.9454	0.9116	0.8190	0.6381	0.4243	0.3599
80	0.9524	0.9510	0.9470	0.9206	0.8442	0.6770	0.4459	0.3674
90	0.9527	0.9513	0.9481	0.9270	0.8632	0.7106	0.4679	0.3757
100	0.9528	0.9515	0.9489	0.9316	0.8779	0.7394	0.4900	0.3845
200	0.9533	0.9528	0.9515	0.9470	0.9316	0.8779	0.6771	0.4901
300	0.9534	0.9532	0.9523	0.9500	0.9429	0.9165	0.7854	0.5938
400	0.9534	0.9533	0.9528	0.9510	0.9470	0.9316	0.8443	0.6771
500	0.9535	0.9534	0.9531	0.9515	0.9489	0.9389	0.8779	0.7395
600	0.9535	0.9534	0.9532	0.9518	0.9500	0.9429	0.8984	0.7854
700	0.9535	0.9534	0.9533	0.9521	0.9506	0.9454	0.9116	0.8191
800	0.9535	0.9534	0.9533	0.9525	0.9510	0.9470	0.9206	0.8443
900	0.9535	0.9535	0.9534	0.9527	0.9513	0.9481	0.9270	0.8633
1000	0.9535	0.9535	0.9534	0.9528	0.9515	0.9489	0.9316	0.8779

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 1.00$ $k\Delta t = 0.10$

	c $\Delta t/\Delta x$							
$L/\Delta x$	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.4939	0.2763	0.1427	0.0576	0.0289	0.0144	0.0058	0.0029
4	0.6901	0.4428	0.2418	0.0995	0.0499	0.0250	0.0100	0.0050
5	0.7838	0.5580	0.3237	0.1362	0.0686	0.0344	0.0138	0.0069
6	0.8353	0.6411	0.3943	0.1704	0.0862	0.0433	0.0173	0.0087
7	0.8665	0.7023	0.4559	0.2029	0.1032	0.0518	0.0208	0.0104
8	0.8868	0.7482	0.5100	0.2340	0.1198	0.0602	0.0241	0.0121
9	0.9008	0.7833	0.5573	0.2640	0.1360	0.0685	0.0275	0.0137
10	0.9108	0.8105	0.5988	0.2929	0.1519	0.0767	0.0308	0.0154
20	0.9428	0.9127	0.8161	0.5264	0.2997	0.1557	0.0630	0.0316
30	0.9487	0.9349	0.8850	0.6735	0.4257	0.2308	0.0947	0.0475
40	0.9508	0.9429	0.9132	0.7626	0.5287	0.3014	0.1259	0.0634
50	0.9518	0.9467	0.9271	0.8176	0.6105	0.3668	0.1568	0.0792
60	0.9523	0.9487	0.9350	0.8529	0.6744	0.4266	0.1871	0.0949
70	0.9528	0.9500	0.9398	0.8765	0.7242	0.4807	0.2168	0.1106
80	0.9532	0.9508	0.9429	0.8929	0.7631	0.5293	0.2459	0.1261
90	0.9535	0.9514	0.9451	0.9046	0.7936	0.5725	0.2743	0.1416
100	0.9537	0.9518	0.9467	0.9133	0.8178	0.6108	0.3018	0.1569
200	0.9543	0.9537	0.9518	0.9429	0.9134	0.8179	0.5294	0.3019
300	0.9545	0.9542	0.9530	0.9487	0.9350	0.8855	0.6747	0.4269
400	0.9545	0.9543	0.9537	0.9508	0.9429	0.9134	0.7632	0.5294
500	0.9545	0.9544	0.9540	0.9518	0.9467	0.9272	0.8179	0.6109
600	0.9545	0.9545	0.9542	0.9523	0.9487	0.9350	0.8531	0.6747
700	0.9545	0.9545	0.9543	0.9528	0.9500	0.9398	0.8766	0.7244
800	0.9545	0.9545	0.9543	0.9532	0.9508	0.9429	0.8929	0.7632
900	0.9545	0.9545	0.9544	0.9535	0.9514	0.9451	0.9047	0.7937
1000	0.9545	0.9545	0.9544	0.9537	0.9518	0.9467	0.9134	0.8179

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.25$ $k\Delta t = 0.20$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
3	1.4320	2.0548	2.6223	2.9267	2.9811	2.9952	2.9992	2.9998
4	1.1268	1.5442	2.1920	2.7968	2.9445	2.9858	2.9977	2.9994
5	1.0291	1.3130	1.8840	2.6500	2.8976	2.9733	2.9957	2.9989
6	0.9843	1.1882	1.6683	2.5011	2.8431	2.9580	2.9931	2.9983
7	0.9597	1.1127	1.5137	2.3578	2.7828	2.9403	2.9902	2.9975
8	0.9446	1.0635	1.4000	2.2244	2.7183	2.9202	2.9867	2.9967
9	0.9347	1.0295	1.3142	2.1025	2.6511	2.8980	2.9829	2.9957
10	0.9277	1.0052	1.2481	1.9926	2.5824	2.8739	2.9785	2.9946
20	0.9065	0.9264	1.0003	1.3688	1.9678	2.5658	2.9131	2.9774
30	0.9027	0.9116	0.9459	1.1467	1.5859	2.2380	2.8140	2.9496
40	0.9033	0.9064	0.9260	1.0492	1.3646	1.9617	2.6930	2.9120
50	0.9038	0.9040	0.9167	0.9990	1.2308	1.7470	2.5612	2.8661
60	0.9041	0.9027	0.9115	0.9702	1.1455	1.5836	2.4272	2.8131
70	0.9043	0.9029	0.9084	0.9522	1.0885	1.4592	2.2974	2.7547
80	0.9044	0.9033	0.9064	0.9403	1.0488	1.3636	2.1752	2.6923
90	0.9045	0.9036	0.9050	0.9320	1.0201	1.2891	2.0626	2.6271
100	0.9045	0.9038	0.9040	0.9260	0.9988	1.2303	1.9601	2.5605
200	0.9047	0.9045	0.9038	0.9064	0.9259	0.9988	1.3633	1.9598
300	0.9047	0.9047	0.9044	0.9027	0.9115	0.9456	1.1452	1.5828
400	0.9047	0.9047	0.9045	0.9033	0.9064	0.9259	1.0486	1.3632
500	0.9048	0.9047	0.9046	0.9038	0.9040	0.9166	0.9988	1.2301
600	0.9048	0.9047	0.9047	0.9041	0.9027	0.9115	0.9701	1.1452
700	0.9048	0.9047	0.9047	0.9043	0.9029	0.9084	0.9521	1.0883
800	0.9048	0.9047	0.9047	0.9044	0.9033	0.9064	0.9402	1.0486
900	0.9048	0.9048	0.9047	0.9045	0.9036	0.9050	0.9319	1.0200
1000	0.9048	0.9048	0.9047	0.9045	0.9038	0.9040	0.9259	0.9988

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.50$ $k\Delta t = 0.20$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0.9444	0.9753	0.9923	0.9987	0.9997	0.9999	1.0000	1.0000
4	0.9230	0.9512	0.9802	0.9962	0.9990	0.9998	1.0000	1.0000
5	0.9152	0.9366	0.9684	0.9930	0.9981	0.9995	0.9999	1.0000
6	0.9116	0.9276	0.9580	0.9893	0.9971	0.9993	0.9999	1.0000
7	0.9096	0.9219	0.9494	0.9854	0.9959	0.9989	0.9998	1.0000
8	0.9083	0.9180	0.9424	0.9813	0.9945	0.9986	0.9998	0.9999
9	0.9075	0.9153	0.9366	0.9771	0.9930	0.9981	0.9997	0.9999
10	0.9069	0.9133	0.9320	0.9729	0.9914	0.9977	0.9996	0.9999
20	0.9051	0.9068	0.9129	0.9403	0.9719	0.9910	0.9984	0.9996
30	0.9048	0.9055	0.9084	0.9245	0.9536	0.9817	0.9965	0.9991
40	0.9064	0.9051	0.9067	0.9169	0.9400	0.9716	0.9940	0.9984
50	0.9074	0.9049	0.9060	0.9128	0.9307	0.9620	0.9909	0.9975
60	0.9079	0.9048	0.9055	0.9104	0.9244	0.9534	0.9874	0.9965
70	0.9082	0.9056	0.9053	0.9089	0.9200	0.9461	0.9836	0.9953
80	0.9084	0.9064	0.9051	0.9079	0.9168	0.9400	0.9796	0.9939
90	0.9086	0.9070	0.9050	0.9072	0.9145	0.9349	0.9756	0.9924
100	0.9087	0.9074	0.9049	0.9067	0.9128	0.9307	0.9716	0.9908
200	0.9090	0.9087	0.9074	0.9051	0.9067	0.9128	0.9400	0.9716
300	0.9090	0.9089	0.9083	0.9048	0.9055	0.9084	0.9244	0.9534
400	0.9091	0.9090	0.9087	0.9064	0.9051	0.9067	0.9168	0.9400
500	0.9091	0.9090	0.9088	0.9074	0.9049	0.9060	0.9128	0.9307
600	0.9091	0.9090	0.9089	0.9079	0.9048	0.9055	0.9104	0.9244
700	0.9091	0.9091	0.9090	0.9082	0.9056	0.9053	0.9089	0.9200
800	0.9091	0.9091	0.9090	0.9084	0.9064	0.9051	0.9079	0.9168
900	0.9091	0.9091	0.9090	0.9086	0.9070	0.9050	0.9072	0.9145
1000	0.9091	0.9091	0.9090	0.9087	0.9074	0.9049	0.9067	0.9128

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 0.75$ $k\Delta t = 0.20$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333
3	0.6332	0.4639	0.3746	0.3405	0.3352	0.3338	0.3334	0.3334
4	0.7689	0.5941	0.4383	0.3542	0.3387	0.3347	0.3336	0.3334
5	0.8242	0.6803	0.5005	0.3712	0.3435	0.3359	0.3337	0.3334
6	0.8520	0.7375	0.5561	0.3904	0.3492	0.3374	0.3340	0.3335
7	0.8679	0.7765	0.6042	0.4111	0.3557	0.3392	0.3343	0.3336
8	0.8779	0.8040	0.6452	0.4327	0.3630	0.3412	0.3346	0.3337
9	0.8846	0.8240	0.6798	0.4546	0.3710	0.3434	0.3350	0.3337
10	0.8894	0.8389	0.7090	0.4766	0.3796	0.3459	0.3354	0.3339
20	0.9041	0.8903	0.8419	0.6574	0.4818	0.3818	0.3419	0.3355
30	0.9068	0.9005	0.8770	0.7585	0.5808	0.4304	0.3523	0.3382
40	0.9093	0.9042	0.8905	0.8123	0.6591	0.4831	0.3660	0.3420
50	0.9106	0.9059	0.8970	0.8427	0.7170	0.5344	0.3824	0.3467
60	0.9114	0.9068	0.9006	0.8611	0.7591	0.5815	0.4008	0.3524
70	0.9118	0.9081	0.9028	0.8729	0.7898	0.6232	0.4206	0.3589
80	0.9121	0.9093	0.9042	0.8808	0.8125	0.6595	0.4413	0.3661
90	0.9123	0.9101	0.9052	0.8865	0.8297	0.6906	0.4623	0.3740
100	0.9124	0.9106	0.9059	0.8906	0.8428	0.7172	0.4835	0.3825
200	0.9129	0.9124	0.9106	0.9042	0.8906	0.8428	0.6596	0.4835
300	0.9130	0.9128	0.9120	0.9068	0.9006	0.8773	0.7592	0.5817
400	0.9130	0.9129	0.9124	0.9093	0.9042	0.8906	0.8126	0.6596
500	0.9130	0.9129	0.9127	0.9106	0.9059	0.8970	0.8428	0.7173
600	0.9130	0.9130	0.9128	0.9114	0.9068	0.9006	0.8611	0.7593
700	0.9130	0.9130	0.9128	0.9118	0.9082	0.9028	0.8729	0.7899
800	0.9130	0.9130	0.9129	0.9121	0.9093	0.9042	0.8809	0.8126
900	0.9130	0.9130	0.9129	0.9123	0.9101	0.9052	0.8865	0.8297
1000	0.9130	0.9130	0.9129	0.9124	0.9106	0.9059	0.8906	0.8428

ESQUEMA DE PREISSMANN

VALORES DE R1 $\theta = 1.00$ $k\Delta t = 0.20$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.4880	0.2752	0.1426	0.0576	0.0289	0.0144	0.0058	0.0029
4	0.6742	0.4385	0.2411	0.0994	0.0499	0.0250	0.0100	0.0050
5	0.7608	0.5495	0.3220	0.1361	0.0686	0.0344	0.0138	0.0069
6	0.8076	0.6283	0.3912	0.1702	0.0862	0.0433	0.0173	0.0087
7	0.8357	0.6856	0.4513	0.2025	0.1032	0.0518	0.0208	0.0104
8	0.8539	0.7281	0.5035	0.2334	0.1197	0.0602	0.0241	0.0121
9	0.8663	0.7603	0.5489	0.2631	0.1358	0.0685	0.0275	0.0137
10	0.8752	0.7851	0.5883	0.2916	0.1517	0.0767	0.0308	0.0154
20	0.9035	0.8769	0.7902	0.5193	0.2984	0.1555	0.0630	0.0315
30	0.9087	0.8965	0.8523	0.6587	0.4219	0.2302	0.0946	0.0475
40	0.9120	0.9036	0.8774	0.7414	0.5215	0.3000	0.1258	0.0634
50	0.9137	0.9069	0.8897	0.7916	0.5994	0.3643	0.1566	0.0792
60	0.9146	0.9087	0.8966	0.8235	0.6596	0.4228	0.1868	0.0949
70	0.9151	0.9105	0.9008	0.8446	0.7059	0.4753	0.2163	0.1105
80	0.9155	0.9120	0.9036	0.8593	0.7418	0.5220	0.2452	0.1260
90	0.9157	0.9130	0.9055	0.8697	0.7697	0.5633	0.2732	0.1415
100	0.9159	0.9137	0.9069	0.8775	0.7918	0.5997	0.3005	0.1567
200	0.9165	0.9159	0.9137	0.9036	0.8775	0.7918	0.5222	0.3005
300	0.9166	0.9163	0.9153	0.9087	0.8966	0.8527	0.6599	0.4231
400	0.9166	0.9165	0.9159	0.9120	0.9036	0.8775	0.7419	0.5222
500	0.9166	0.9165	0.9162	0.9137	0.9069	0.8898	0.7919	0.5998
600	0.9166	0.9166	0.9163	0.9146	0.9087	0.8966	0.8236	0.6599
700	0.9167	0.9166	0.9164	0.9151	0.9106	0.9009	0.8447	0.7061
800	0.9167	0.9166	0.9165	0.9155	0.9120	0.9036	0.8593	0.7419
900	0.9167	0.9166	0.9165	0.9157	0.9130	0.9055	0.8698	0.7698
1000	0.9167	0.9166	0.9165	0.9159	0.9137	0.9069	0.8775	0.7919

ESQUEMA DE PREISSMANN

VALORES DE R2 $\theta = 0.25$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	1.2637	0.9153	0.5796	0.2710	0.1427	0.0732	0.0297	0.0149
4	1.1312	0.9208	0.6476	0.3347	0.1832	0.0958	0.0393	0.0198
5	1.0800	0.9365	0.7039	0.3910	0.2213	0.1177	0.0488	0.0247
6	1.0542	0.9499	0.7500	0.4409	0.2572	0.1391	0.0582	0.0296
7	1.0393	0.9602	0.7877	0.4854	0.2908	0.1597	0.0675	0.0344
8	1.0298	0.9679	0.8186	0.5251	0.3224	0.1798	0.0767	0.0392
9	1.0234	0.9737	0.8439	0.5609	0.3521	0.1993	0.0858	0.0440
10	1.0189	0.9781	0.8648	0.5932	0.3800	0.2181	0.0948	0.0487
20	1.0046	0.9940	0.9560	0.7946	0.5864	0.3774	0.1789	0.0947
30	1.0021	0.9973	0.9792	0.8828	0.7111	0.4951	0.2532	0.1380
40	1.0012	0.9985	0.9880	0.9263	0.7913	0.5847	0.3188	0.1788
50	1.0007	0.9990	0.9923	0.9500	0.8445	0.6546	0.3766	0.2171
60	1.0005	0.9993	0.9946	0.9641	0.8809	0.7100	0.4279	0.2531
70	1.0004	0.9995	0.9960	0.9730	0.9065	0.7545	0.4736	0.2869
80	1.0003	0.9996	0.9969	0.9791	0.9251	0.7904	0.5144	0.3186
90	1.0002	0.9997	0.9976	0.9833	0.9388	0.8198	0.5511	0.3485
100	1.0002	0.9998	0.9980	0.9864	0.9491	0.8439	0.5842	0.3765
200	1.0000	0.9999	0.9995	0.9965	0.9861	0.9489	0.7902	0.5842
300	1.0000	1.0000	0.9998	0.9984	0.9937	0.9758	0.8803	0.7096
400	1.0000	1.0000	0.9999	0.9991	0.9965	0.9861	0.9247	0.7902
500	1.0000	1.0000	0.9999	0.9994	0.9977	0.9910	0.9489	0.8437
600	1.0000	1.0000	0.9999	0.9996	0.9984	0.9937	0.9633	0.8803
700	1.0000	1.0000	1.0000	0.9997	0.9988	0.9954	0.9724	0.9060
800	1.0000	1.0000	1.0000	0.9998	0.9991	0.9964	0.9786	0.9246
900	1.0000	1.0000	1.0000	0.9998	0.9993	0.9972	0.9829	0.9384
1000	1.0000	1.0000	1.0000	0.9999	0.9994	0.9977	0.9861	0.9489

ESQUEMA DE PREISSMANN

VALORES DE R2 $\theta = 0.50$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	1.3631	1.0000	0.6158	0.2780	0.1445	0.0736	0.0298	0.0149
4	1.1807	1.0000	0.7048	0.3497	0.1873	0.0968	0.0395	0.0199
5	1.1091	1.0000	0.7703	0.4145	0.2282	0.1195	0.0491	0.0248
6	1.0735	1.0000	0.8184	0.4726	0.2672	0.1418	0.0587	0.0297
7	1.0530	1.0000	0.8541	0.5246	0.3044	0.1635	0.0682	0.0345
8	1.0401	1.0000	0.8809	0.5709	0.3397	0.1847	0.0775	0.0394
9	1.0314	1.0000	0.9013	0.6121	0.3732	0.2054	0.0869	0.0442
10	1.0253	1.0000	0.9171	0.6487	0.4050	0.2257	0.0961	0.0490
20	1.0062	1.0000	0.9765	0.8528	0.6415	0.4027	0.1840	0.0960
30	1.0027	1.0000	0.9893	0.9241	0.7738	0.5380	0.2641	0.1409
40	1.0015	1.0000	0.9939	0.9547	0.8490	0.6397	0.3366	0.1839
50	1.0010	1.0000	0.9961	0.9701	0.8938	0.7156	0.4020	0.2249
60	1.0007	1.0000	0.9973	0.9789	0.9219	0.7724	0.4607	0.2640
70	1.0005	1.0000	0.9980	0.9843	0.9405	0.8153	0.5133	0.3012
80	1.0004	1.0000	0.9985	0.9879	0.9533	0.8480	0.5602	0.3365
90	1.0003	1.0000	0.9988	0.9904	0.9625	0.8733	0.6020	0.3701
100	1.0002	1.0000	0.9990	0.9922	0.9692	0.8931	0.6392	0.4019
200	1.0001	1.0000	0.9998	0.9980	0.9920	0.9690	0.8477	0.6391
300	1.0000	1.0000	0.9999	0.9991	0.9964	0.9858	0.9212	0.7720
400	1.0000	1.0000	0.9999	0.9995	0.9980	0.9919	0.9529	0.8477
500	1.0000	1.0000	1.0000	0.9997	0.9987	0.9948	0.9689	0.8928
600	1.0000	1.0000	1.0000	0.9998	0.9991	0.9964	0.9781	0.9212
700	1.0000	1.0000	1.0000	0.9998	0.9993	0.9973	0.9837	0.9400
800	1.0000	1.0000	1.0000	0.9999	0.9995	0.9980	0.9874	0.9529
900	1.0000	1.0000	1.0000	0.9999	0.9996	0.9984	0.9900	0.9621
1000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9987	0.9919	0.9689

ESQUEMA DE PREISSMANN

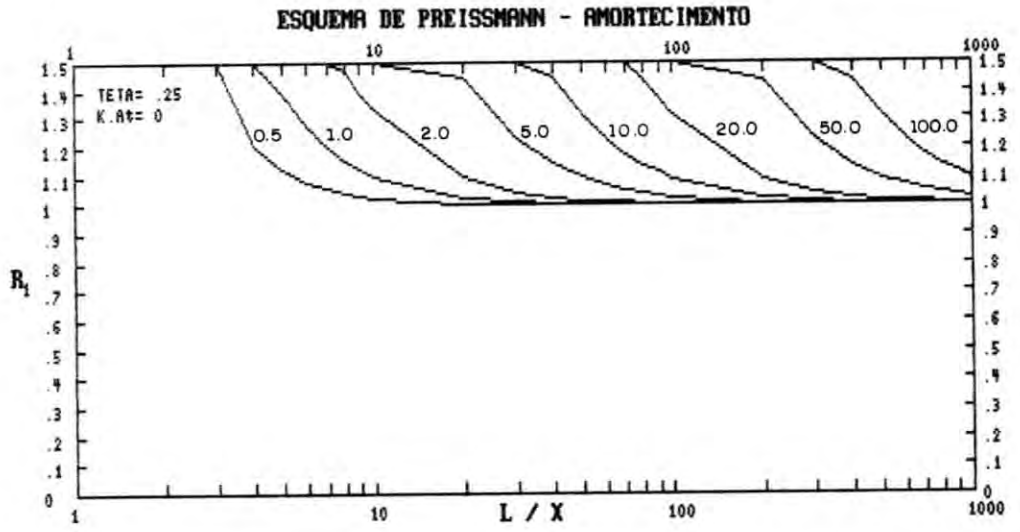
VALORES DE R2 $\theta = 0.75$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	1.2637	0.9153	0.5796	0.2710	0.1427	0.0732	0.0297	0.0149
4	1.1312	0.9208	0.6476	0.3347	0.1832	0.0958	0.0393	0.0198
5	1.0800	0.9365	0.7039	0.3910	0.2213	0.1177	0.0488	0.0247
6	1.0542	0.9499	0.7500	0.4409	0.2572	0.1391	0.0582	0.0296
7	1.0393	0.9602	0.7877	0.4854	0.2908	0.1597	0.0675	0.0344
8	1.0298	0.9679	0.8186	0.5251	0.3224	0.1798	0.0767	0.0392
9	1.0234	0.9737	0.8439	0.5609	0.3521	0.1993	0.0858	0.0440
10	1.0189	0.9781	0.8648	0.5932	0.3800	0.2181	0.0948	0.0487
20	1.0046	0.9940	0.9560	0.7946	0.5864	0.3774	0.1789	0.0947
30	1.0021	0.9973	0.9792	0.8828	0.7111	0.4951	0.2532	0.1380
40	1.0012	0.9985	0.9880	0.9263	0.7913	0.5847	0.3188	0.1788
50	1.0007	0.9990	0.9923	0.9500	0.8445	0.6546	0.3766	0.2171
60	1.0005	0.9993	0.9946	0.9641	0.8809	0.7100	0.4279	0.2531
70	1.0004	0.9995	0.9960	0.9730	0.9065	0.7545	0.4736	0.2869
80	1.0003	0.9996	0.9969	0.9791	0.9251	0.7904	0.5144	0.3186
90	1.0002	0.9997	0.9976	0.9833	0.9388	0.8198	0.5511	0.3485
100	1.0002	0.9998	0.9980	0.9864	0.9491	0.8439	0.5842	0.3765
200	1.0000	0.9999	0.9995	0.9965	0.9861	0.9489	0.7902	0.5842
300	1.0000	1.0000	0.9998	0.9984	0.9937	0.9758	0.8803	0.7096
400	1.0000	1.0000	0.9999	0.9991	0.9965	0.9861	0.9247	0.7902
500	1.0000	1.0000	0.9999	0.9994	0.9977	0.9910	0.9489	0.8437
600	1.0000	1.0000	0.9999	0.9996	0.9984	0.9937	0.9633	0.8803
700	1.0000	1.0000	1.0000	0.9997	0.9988	0.9954	0.9724	0.9060
800	1.0000	1.0000	1.0000	0.9998	0.9991	0.9964	0.9786	0.9246
900	1.0000	1.0000	1.0000	0.9998	0.9993	0.9972	0.9829	0.9384
1000	1.0000	1.0000	1.0000	0.9999	0.9994	0.9977	0.9861	0.9489

ESQUEMA DE PREISSMANN

VALORES DE R2 θ = 1.00 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	1.0000	0.6158	0.3408	0.1445	0.0736	0.0372	0.0149	0.0075
4	1.0000	0.7048	0.4220	0.1873	0.0968	0.0492	0.0199	0.0100
5	1.0000	0.7703	0.4931	0.2282	0.1195	0.0611	0.0248	0.0124
6	1.0000	0.8184	0.5549	0.2672	0.1418	0.0729	0.0297	0.0149
7	1.0000	0.8541	0.6083	0.3044	0.1635	0.0846	0.0345	0.0174
8	1.0000	0.8809	0.6543	0.3397	0.1847	0.0962	0.0394	0.0198
9	1.0000	0.9013	0.6940	0.3732	0.2054	0.1076	0.0442	0.0223
10	1.0000	0.9171	0.7281	0.4050	0.2257	0.1189	0.0490	0.0248
20	1.0000	0.9765	0.8988	0.6415	0.4027	0.2251	0.0960	0.0490
30	1.0000	0.9893	0.9501	0.7738	0.5380	0.3193	0.1409	0.0727
40	1.0000	0.9939	0.9708	0.8490	0.6397	0.4021	0.1839	0.0960
50	1.0000	0.9961	0.9809	0.8938	0.7156	0.4745	0.2249	0.1187
60	1.0000	0.9973	0.9866	0.9219	0.7724	0.5375	0.2640	0.1409
70	1.0000	0.9980	0.9901	0.9405	0.8153	0.5921	0.3012	0.1626
80	1.0000	0.9985	0.9924	0.9533	0.8480	0.6392	0.3365	0.1839
90	1.0000	0.9988	0.9940	0.9625	0.8733	0.6800	0.3701	0.2046
100	1.0000	0.9990	0.9951	0.9692	0.8931	0.7152	0.4019	0.2249
200	1.0000	0.9998	0.9988	0.9920	0.9690	0.8929	0.6391	0.4019
300	1.0000	0.9999	0.9995	0.9964	0.9858	0.9470	0.7720	0.5373
400	1.0000	0.9999	0.9997	0.9980	0.9919	0.9689	0.8477	0.6391
500	1.0000	1.0000	0.9998	0.9987	0.9948	0.9797	0.8928	0.7151
600	1.0000	1.0000	0.9999	0.9991	0.9964	0.9858	0.9212	0.7720
700	1.0000	1.0000	0.9999	0.9993	0.9973	0.9895	0.9400	0.8149
800	1.0000	1.0000	0.9999	0.9995	0.9980	0.9919	0.9529	0.8477
900	1.0000	1.0000	0.9999	0.9996	0.9984	0.9936	0.9621	0.8730
1000	1.0000	1.0000	1.0000	0.9997	0.9987	0.9948	0.9689	0.8928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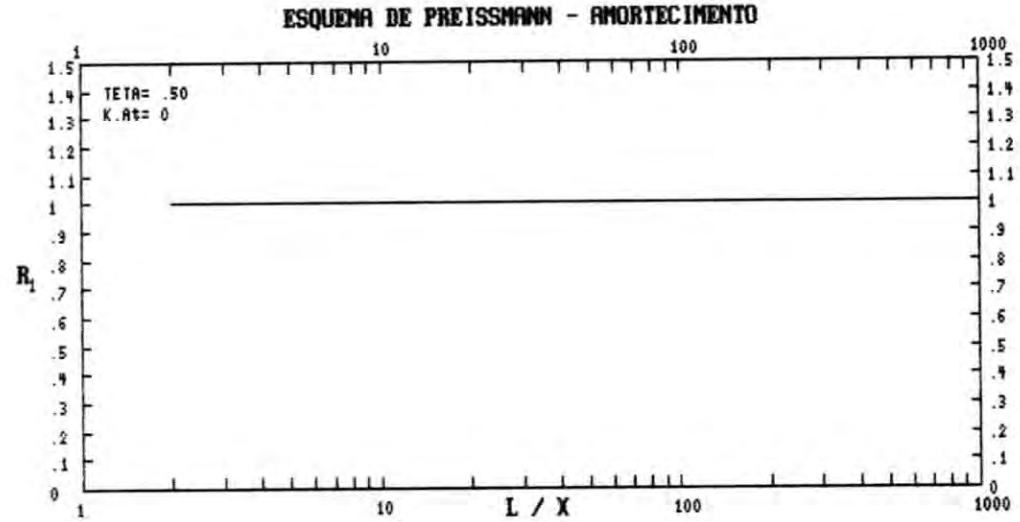
1.0
2.0
5.0
10.0
20.0
50.0
100.0
R1
L / X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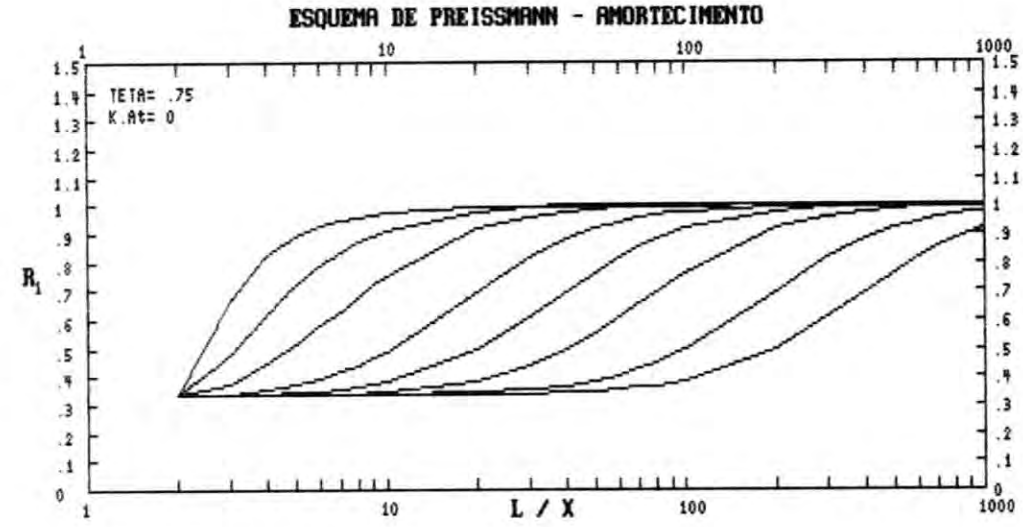
R1
L / X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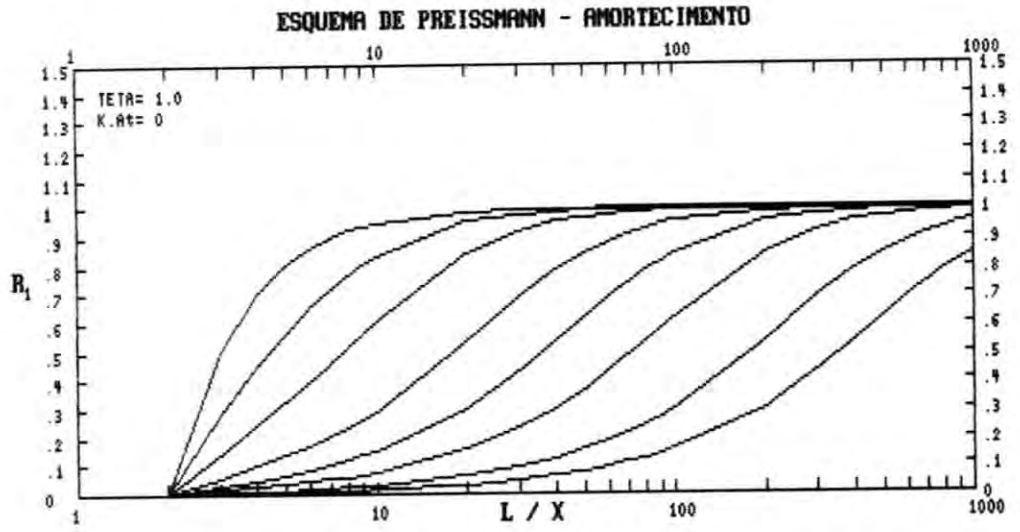
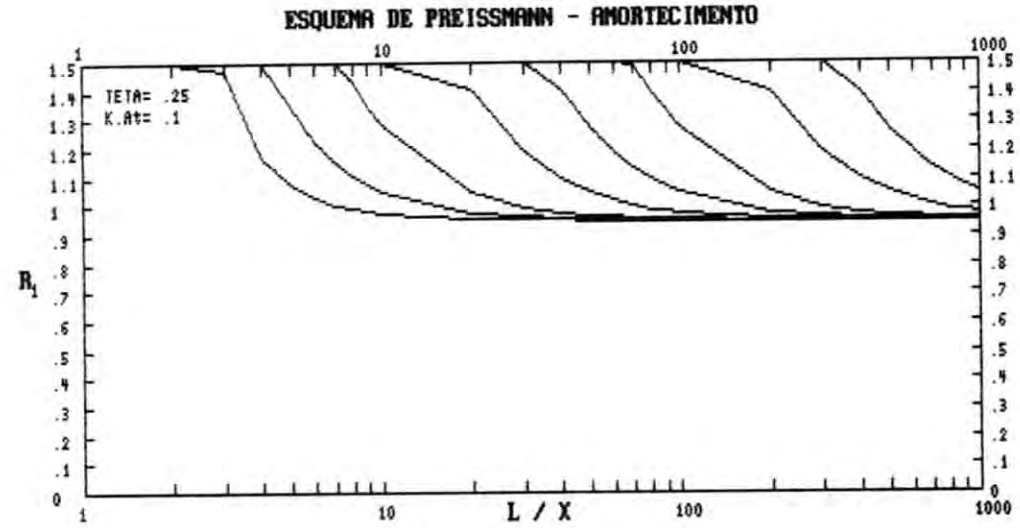
K.At= 0
R1
L / X


ESQUEMA DE PREISSMANN - AMORTECIMENTO
TETA= 1.0
K.At= 0
R1
L / X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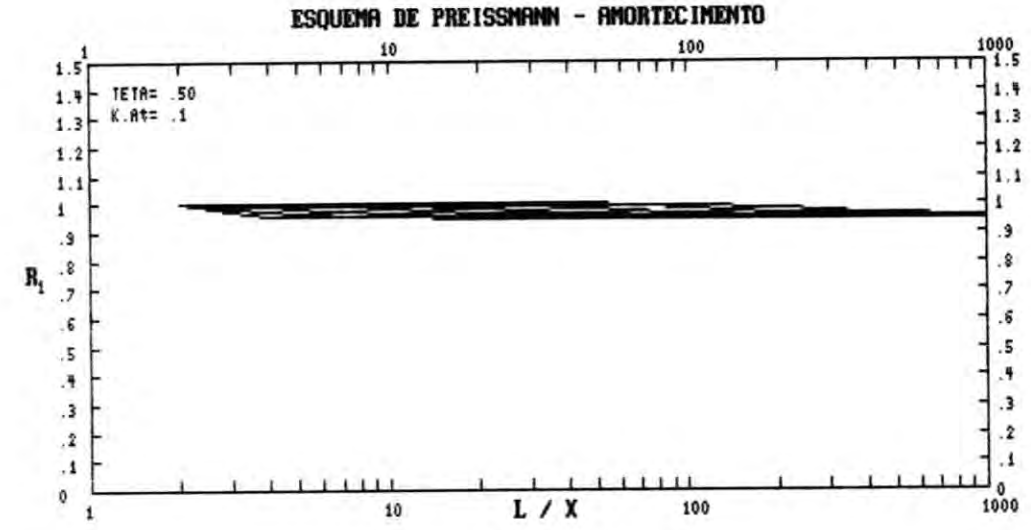
K.At= .1
R1
L / X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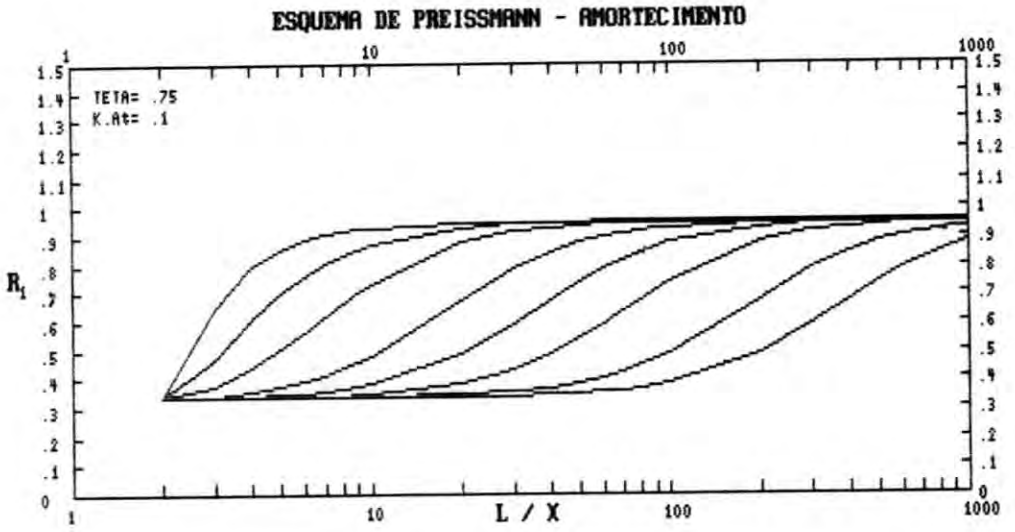
K.At= .1
R1
L / X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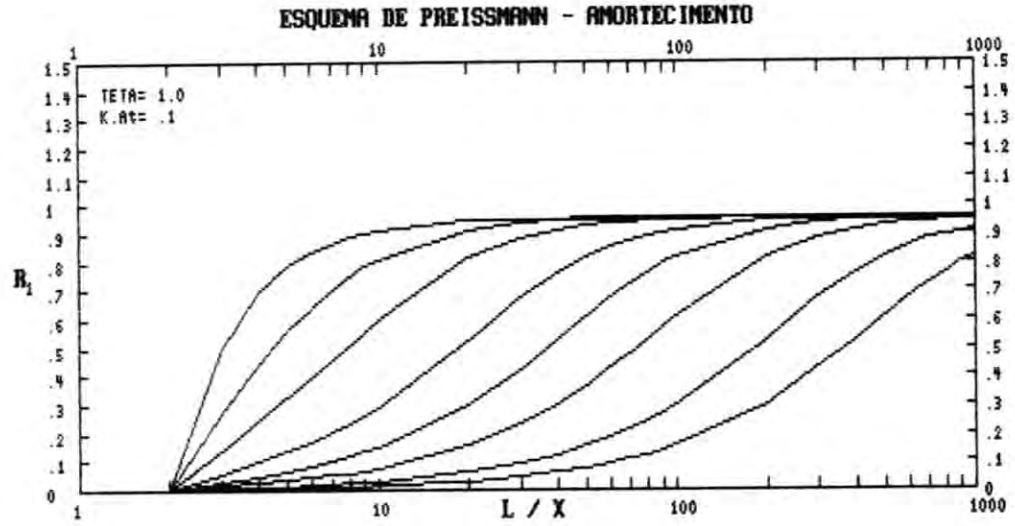
K.At= .1
R1
L / X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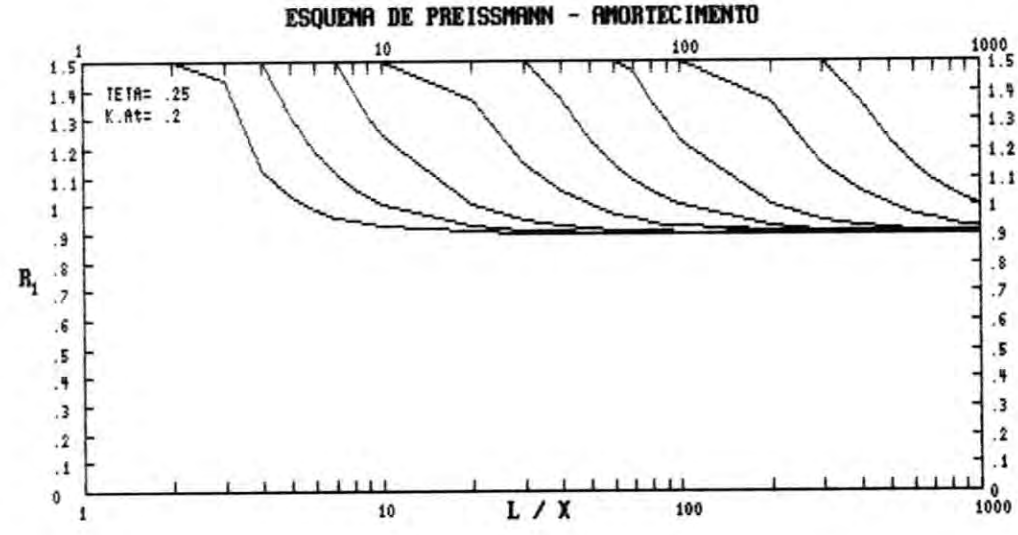
K.At= .1
R1
L / X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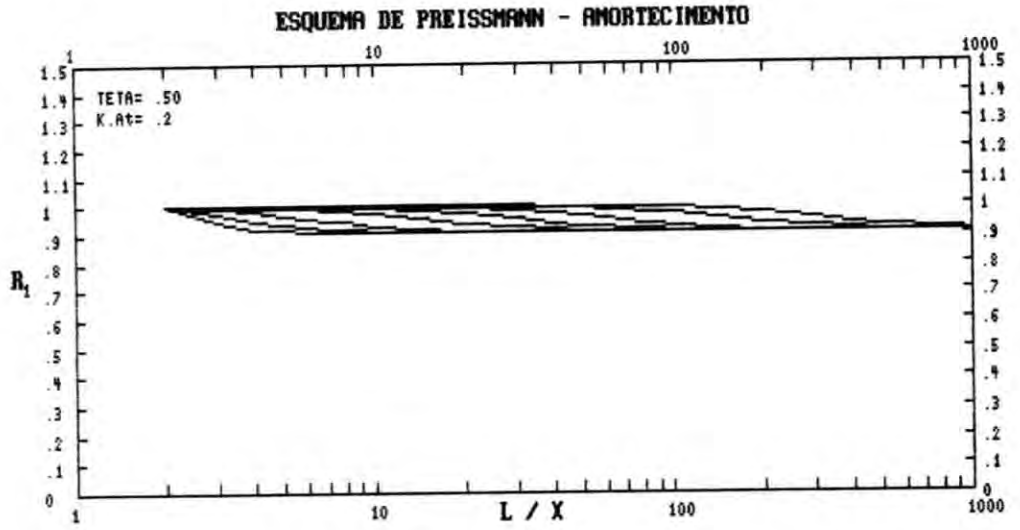
R1
L / X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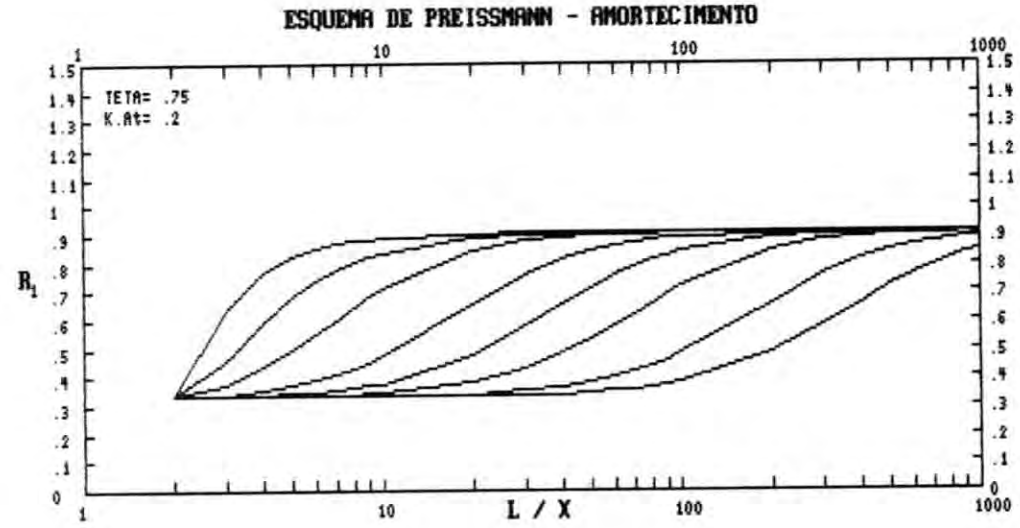
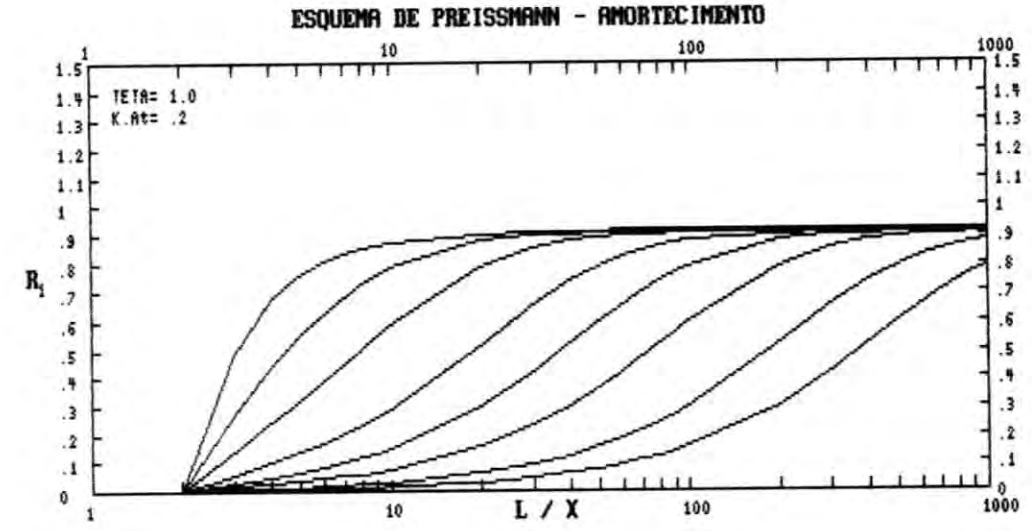
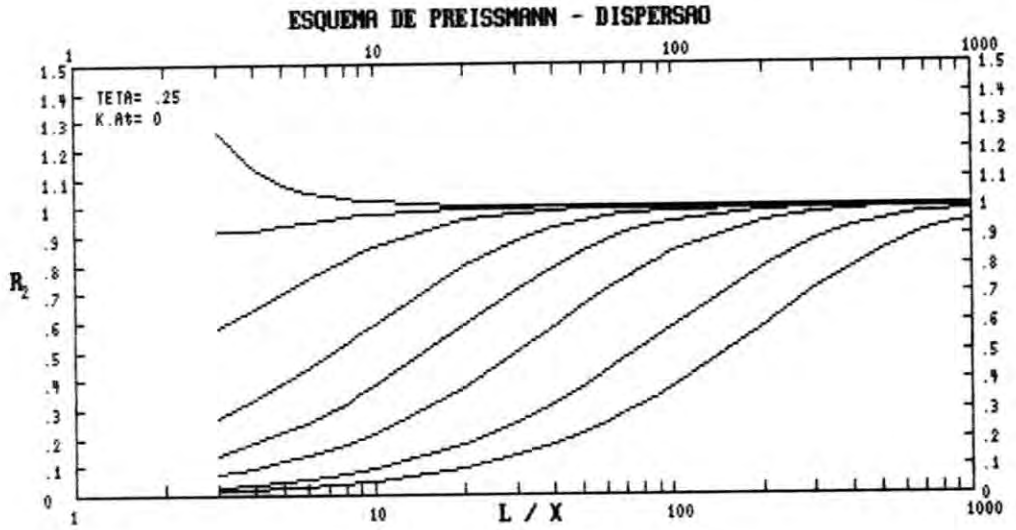
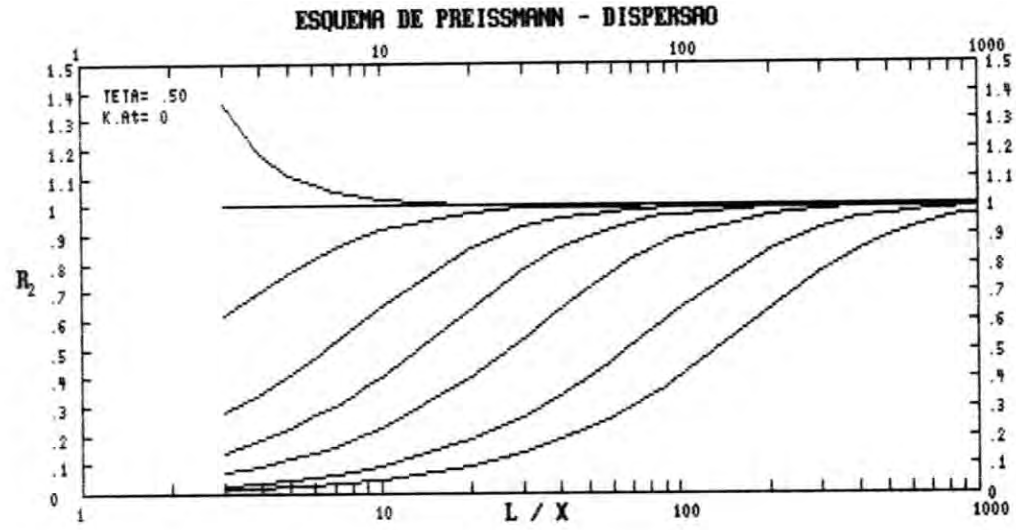
K.At= .2
R1
L / X
1
10
100
1000


ESQUEMA DE PREISSMANN - AMORTECIMENTO
TETA= .75
K.At= .2
R1
L / X
1
10
100
1000


ESQUEMA DE PREISSMANN - AMORTECIMENTO
TETA= 1.0
K.At= .2
R1
L / X
1
10
100
1000


ESQUEMA DE PREISSMANN - DISPERSAO
TETA= .25
K.At= 0
R2
L / X


ESQUEMA DE PREISSMANN - DISPERSAO
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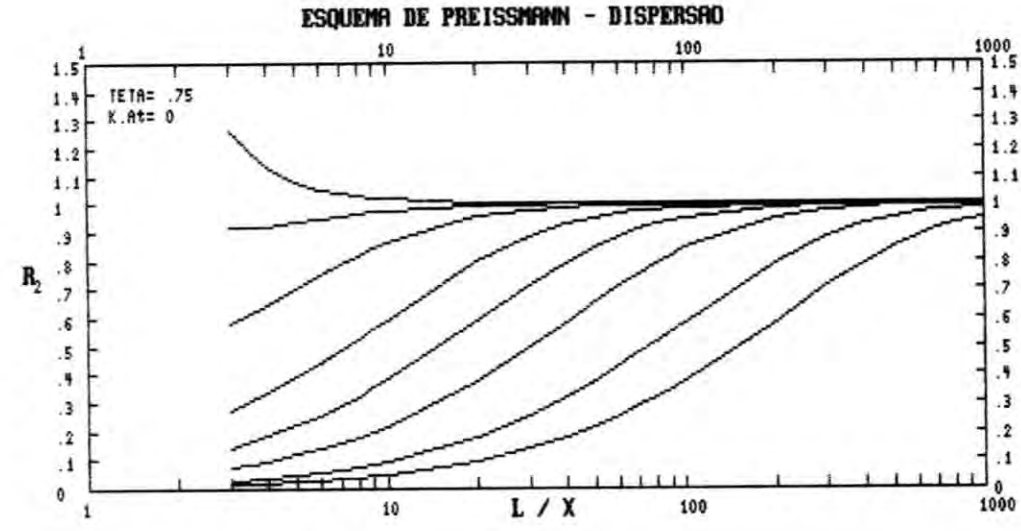
K.At= 0
R2
L / X


ESQUEMA DE PREISSMANN - DISPERSAO
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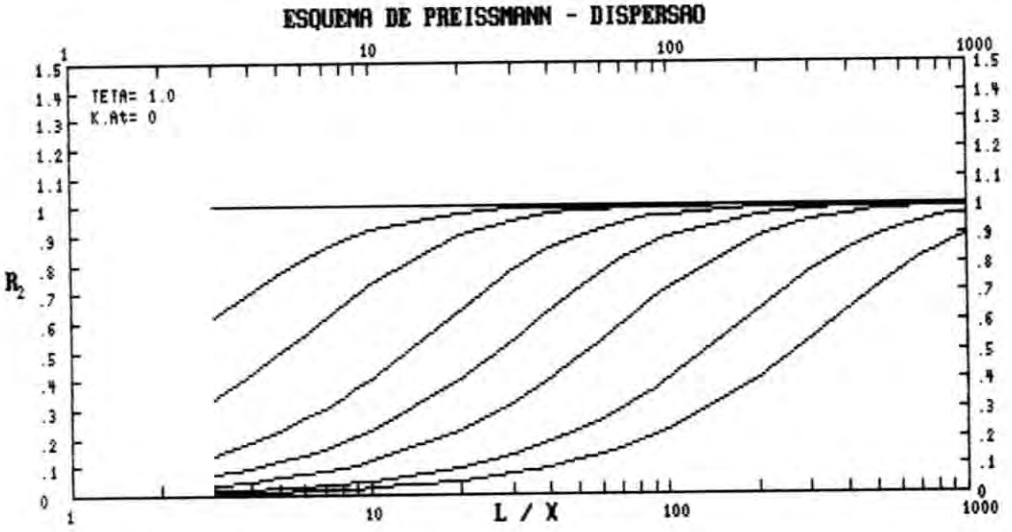
K.At= 0
R2
L / X


ESQUEMA DE PREISSMANN - DISPERSAO
TETA= 1.0
K.At= 0
R2
L / X
1
10
100
1000
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
1.1
1.2
1.3
1.4
1.5

I.2 ESQUEMA PROPOSTO

Os valores dos coeficientes R_1 e R_2, respectivamente de amortecimento e dispersão, calculados para o esquema implícito proposto são apresentados nas tabelas e gráficos seguinte. As expressões utilizadas para o cálculo são:

$$e^{\beta_n \Delta t} = 1 + \frac{-b + 2\theta R_c^2 a^2 + \left[b^2 + 4 R_c^2 a^2 \right]^{1/2}}{2 (1 - \theta^2 R_c^2 a^2 + \theta b)} \qquad [I.2.1]$$

onde

$$a = \left(e^{-\sigma_n \Delta x} - 1 \right)$$

$$R_c = c \frac{\Delta t}{\Delta x}$$

$$b = k \Delta t$$

Sendo $R_1 = e^{-\tilde{\beta}_n^I \Delta t} / e^{-\beta_n^I \Delta t}$, o módulo $e^{-\tilde{\beta}_n^I \Delta t}$ pode ser calculado decompondo-se a expressão [I.2.1] nas funções trigonométricas usuais. Assim, supondo b=0:

$$e^{\beta_n \Delta t i} = e^{-\beta_n \Delta t} \left[\cos(\beta_n^R \Delta t) + \sin(\beta_n^R \Delta t) i \right] \qquad [I.2.2]$$

$$e^{\beta_n \Delta t i} = 1 + \frac{X_a + Y_a i}{X_b + Y_b i} \qquad [I.2.3]$$

onde

$$X_a = \left\{ 2\, R_c^2 \theta \cos(\sigma_n \Delta x) \left[\cos(\sigma_n \Delta x) - 1 \right] \pm R_c \left[\cos(\sigma_n \Delta x) - 1 \right] \right\}$$

$$X_b = \left\{ 2\, R_c^2 \theta \sin(\sigma_n \Delta x) \left[\cos(\sigma_n \Delta x) - 1 \right] \pm R_c \sin(\sigma_n \Delta x) \right\}$$

$$X_b = \left\{ 1 - 2\, R_c^2 \theta^2 \cos(\sigma_n \Delta x) \left[\cos(\sigma_n \Delta x) - 1 \right] \right\}$$

$$Y_b = \left\{ - 2\, R_c^2 \theta^2 \sin(\sigma_n \Delta x) \left[\cos(\sigma_n \Delta x) - 1 \right] \right\}$$

Igualando-se [I.2.3] e [I.2.4] obtém-se o módulo e o argumento desejados.

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.20 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.1667	0.4286	1.2222	2.3333	3.0000	3.4444	3.7619	3.8780
3	0.4588	0.5498	1.2032	2.2991	2.9824	3.4380	3.7606	3.8777
4	0.6529	0.6778	1.1736	2.2361	2.9483	3.4252	3.7579	3.8770
5	0.7617	0.7648	1.1453	2.1614	2.9046	3.4082	3.7544	3.8760
6	0.8275	0.8231	1.1209	2.0817	2.8536	3.3877	3.7501	3.8748
7	0.8698	0.8631	1.1008	2.0012	2.7970	3.3638	3.7449	3.8734
8	0.8985	0.8914	1.0846	1.9229	2.7363	3.3369	3.7390	3.8718
9	0.9188	0.9120	1.0716	1.8485	2.6729	3.3073	3.7324	3.8699
10	0.9337	0.9274	1.0611	1.7792	2.6080	3.2752	3.7250	3.8679
20	0.9829	0.9807	1.0184	1.3486	2.0207	2.8777	3.6141	3.8359
30	0.9924	0.9913	1.0085	1.1840	1.6527	2.4760	3.4514	3.7844
40	0.9957	0.9951	1.0048	1.1112	1.4397	2.1517	3.2600	3.7161
50	0.9972	0.9969	1.0031	1.0737	1.3116	1.9072	3.0597	3.6339
60	0.9981	0.9978	1.0022	1.0522	1.2305	1.7254	2.8643	3.5412
70	0.9986	0.9984	1.0016	1.0389	1.1764	1.5892	2.6816	3.4412
80	0.9989	0.9988	1.0012	1.0300	1.1390	1.4858	2.5154	3.3368
90	0.9991	0.9990	1.0010	1.0238	1.1121	1.4059	2.3663	3.2305
100	0.9993	0.9992	1.0008	1.0194	1.0921	1.3434	2.2339	3.1244
200	0.9998	0.9998	1.0002	1.0049	1.0242	1.1013	1.5136	2.2619
300	0.9999	0.9999	1.0001	1.0022	1.0109	1.0467	1.2676	1.7848
400	1.0000	1.0000	1.0000	1.0012	1.0061	1.0267	1.1612	1.5228
500	1.0000	1.0000	1.0000	1.0008	1.0039	1.0172	1.1068	1.3688
600	1.0000	1.0000	1.0000	1.0005	1.0027	1.0120	1.0757	1.2722
700	1.0000	1.0000	1.0000	1.0004	1.0020	1.0088	1.0563	1.2082
800	1.0000	1.0000	1.0000	1.0003	1.0015	1.0068	1.0435	1.1639
900	1.0000	1.0000	1.0000	1.0002	1.0012	1.0053	1.0346	1.1322
1000	1.0000	1.0000	1.0000	1.0002	1.0010	1.0043	1.0281	1.1087

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.30 $k\Delta t$=0.00

L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.2308	0.2500	0.8182	1.5000	1.8571	2.0769	2.2258	2.2787
3	0.4574	0.4129	0.8311	1.4915	1.8527	2.0754	2.2255	2.2786
4	0.6366	0.5708	0.8521	1.4753	1.8439	2.0722	2.2249	2.2784
5	0.7441	0.6791	0.8732	1.4552	1.8324	2.0681	2.2241	2.2782
6	0.8117	0.7539	0.8921	1.4327	1.8187	2.0630	2.2230	2.2779
7	0.8564	0.8067	0.9084	1.4088	1.8030	2.0570	2.2218	2.2776
8	0.8872	0.8449	0.9220	1.3843	1.7857	2.0502	2.2204	2.2772
9	0.9093	0.8733	0.9332	1.3599	1.7669	2.0425	2.2189	2.2768
10	0.9256	0.8947	0.9424	1.3361	1.7471	2.0341	2.2171	2.2764
20	0.9806	0.9713	0.9819	1.1653	1.5331	1.9186	2.1901	2.2689
30	0.9913	0.9870	0.9916	1.0898	1.3638	1.7770	2.1480	2.2567
40	0.9951	0.9927	0.9952	1.0549	1.2531	1.6415	2.0941	2.2401
50	0.9968	0.9953	0.9969	1.0366	1.1823	1.5258	2.0325	2.2194
60	0.9978	0.9967	0.9978	1.0260	1.1360	1.4319	1.9667	2.1952
70	0.9984	0.9976	0.9984	1.0194	1.1047	1.3573	1.8996	2.1678
80	0.9988	0.9982	0.9988	1.0150	1.0827	1.2983	1.8336	2.1379
90	0.9990	0.9985	0.9990	1.0119	1.0668	1.2515	1.7702	2.1060
100	0.9992	0.9988	0.9992	1.0097	1.0550	1.2141	1.7104	2.0726
200	0.9998	0.9997	0.9998	1.0025	1.0145	1.0643	1.3259	1.7340
300	0.9999	0.9999	0.9999	1.0011	1.0065	1.0297	1.1735	1.4883
400	1.0000	0.9999	1.0000	1.0006	1.0037	1.0170	1.1051	1.3352
500	1.0000	1.0000	1.0000	1.0004	1.0024	1.0109	1.0698	1.2398
600	1.0000	1.0000	1.0000	1.0003	1.0016	1.0076	1.0495	1.1782
700	1.0000	1.0000	1.0000	1.0002	1.0012	1.0056	1.0369	1.1368
800	1.0000	1.0000	1.0000	1.0002	1.0009	1.0043	1.0285	1.1079
900	1.0000	1.0000	1.0000	1.0001	1.0007	1.0034	1.0226	1.0871
1000	1.0000	1.0000	1.0000	1.0001	1.0006	1.0028	1.0184	1.0717

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.40 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.2857	0.1111	0.5385	1.0000	1.2222	1.3529	1.4390	1.4691
3	0.4638	0.3232	0.5686	1.0000	1.2214	1.3526	1.4390	1.4691
4	0.6260	0.4953	0.6176	1.0000	1.2198	1.3519	1.4388	1.4691
5	0.7301	0.6138	0.6674	1.0000	1.2176	1.3509	1.4386	1.4690
6	0.7982	0.6980	0.7129	1.0000	1.2150	1.3498	1.4384	1.4690
7	0.8444	0.7591	0.7526	1.0000	1.2120	1.3484	1.4381	1.4689
8	0.8769	0.8044	0.7866	1.0000	1.2086	1.3469	1.4377	1.4688
9	0.9004	0.8387	0.8152	1.0000	1.2049	1.3451	1.4374	1.4687
10	0.9179	0.8650	0.8392	1.0000	1.2009	1.3432	1.4369	1.4686
20	0.9782	0.9622	0.9471	1.0000	1.1537	1.3152	1.4304	1.4668
30	0.9902	0.9828	0.9750	1.0000	1.1105	1.2776	1.4199	1.4638
40	0.9945	0.9902	0.9856	1.0000	1.0793	1.2381	1.4060	1.4596
50	0.9965	0.9937	0.9907	1.0000	1.0582	1.2013	1.3896	1.4544
60	0.9975	0.9956	0.9935	1.0000	1.0440	1.1694	1.3712	1.4483
70	0.9982	0.9968	0.9952	1.0000	1.0341	1.1427	1.3516	1.4412
80	0.9986	0.9975	0.9963	1.0000	1.0271	1.1208	1.3315	1.4333
90	0.9989	0.9981	0.9971	1.0000	1.0220	1.1029	1.3114	1.4247
100	0.9991	0.9984	0.9976	1.0000	1.0181	1.0883	1.2916	1.4154
200	0.9998	0.9996	0.9994	1.0000	1.0048	1.0273	1.1463	1.3100
300	0.9999	0.9998	0.9997	1.0000	1.0022	1.0127	1.0801	1.2185
400	0.9999	0.9999	0.9999	1.0000	1.0012	1.0072	1.0491	1.1549
500	1.0000	0.9999	0.9999	1.0000	1.0008	1.0047	1.0328	1.1128
600	1.0000	1.0000	0.9999	1.0000	1.0005	1.0033	1.0233	1.0847
700	1.0000	1.0000	1.0000	1.0000	1.0004	1.0024	1.0174	1.0655
800	1.0000	1.0000	1.0000	1.0000	1.0003	1.0018	1.0134	1.0519
900	1.0000	1.0000	1.0000	1.0000	1.0002	1.0015	1.0107	1.0420
1000	1.0000	1.0000	1.0000	1.0000	1.0002	1.0012	1.0087	1.0346

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.50 $k\Delta t$=0.00

L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.3333	0.0000	0.3333	0.6667	0.8182	0.9048	0.9608	0.9802
3	0.4752	0.2774	0.3780	0.6705	0.8187	0.9048	0.9608	0.9802
4	0.6202	0.4472	0.4472	0.6778	0.8198	0.9050	0.9608	0.9802
5	0.7193	0.5669	0.5154	0.6872	0.8213	0.9052	0.9608	0.9802
6	0.7868	0.6547	0.5774	0.6980	0.8231	0.9054	0.9608	0.9802
7	0.8338	0.7203	0.6317	0.7098	0.8251	0.9057	0.9609	0.9802
8	0.8674	0.7701	0.6786	0.7224	0.8274	0.9061	0.9609	0.9802
9	0.8921	0.8085	0.7187	0.7354	0.8300	0.9064	0.9609	0.9802
10	0.9107	0.8385	0.7529	0.7484	0.8327	0.9069	0.9609	0.9802
20	0.9760	0.9533	0.9145	0.8581	0.8668	0.9130	0.9614	0.9803
30	0.9892	0.9786	0.9590	0.9176	0.9005	0.9217	0.9621	0.9804
40	0.9939	0.9878	0.9763	0.9480	0.9265	0.9312	0.9631	0.9805
50	0.9961	0.9922	0.9846	0.9647	0.9450	0.9406	0.9643	0.9807
60	0.9973	0.9946	0.9892	0.9747	0.9579	0.9490	0.9657	0.9809
70	0.9980	0.9960	0.9920	0.9810	0.9670	0.9563	0.9672	0.9811
80	0.9985	0.9969	0.9939	0.9853	0.9736	0.9626	0.9687	0.9814
90	0.9988	0.9976	0.9952	0.9882	0.9785	0.9678	0.9703	0.9817
100	0.9990	0.9980	0.9961	0.9904	0.9822	0.9721	0.9719	0.9820
200	0.9998	0.9995	0.9990	0.9976	0.9952	0.9911	0.9849	0.9859
300	0.9999	0.9998	0.9996	0.9989	0.9978	0.9958	0.9914	0.9896
400	0.9999	0.9999	0.9998	0.9994	0.9988	0.9976	0.9947	0.9924
500	1.0000	0.9999	0.9998	0.9996	0.9992	0.9984	0.9964	0.9944
600	1.0000	0.9999	0.9999	0.9997	0.9995	0.9989	0.9974	0.9957
700	1.0000	1.0000	0.9999	0.9998	0.9996	0.9992	0.9981	0.9967
800	1.0000	1.0000	0.9999	0.9998	0.9997	0.9994	0.9985	0.9973
900	1.0000	1.0000	1.0000	0.9999	0.9998	0.9995	0.9988	0.9978
1000	1.0000	1.0000	1.0000	0.9999	0.9998	0.9996	0.9990	0.9982

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.60 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.3750	0.0909	0.1765	0.4286	0.5385	0.6000	0.6393	0.6529
3	0.4895	0.2686	0.2414	0.4350	0.5398	0.6003	0.6394	0.6529
4	0.6181	0.4220	0.3291	0.4472	0.5423	0.6009	0.6395	0.6529
5	0.7114	0.5360	0.4093	0.4627	0.5457	0.6016	0.6396	0.6529
6	0.7774	0.6227	0.4804	0.4804	0.5498	0.6025	0.6397	0.6530
7	0.8245	0.6896	0.5425	0.4997	0.5546	0.6036	0.6399	0.6530
8	0.8589	0.7417	0.5966	0.5200	0.5600	0.6049	0.6401	0.6531
9	0.8845	0.7827	0.6433	0.5410	0.5660	0.6063	0.6403	0.6531
10	0.9040	0.8152	0.6837	0.5621	0.5724	0.6079	0.6405	0.6532
20	0.9737	0.9448	0.8844	0.7415	0.6523	0.6312	0.6442	0.6541
30	0.9881	0.9745	0.9435	0.8446	0.7332	0.6641	0.6502	0.6556
40	0.9933	0.9855	0.9671	0.9000	0.7980	0.7010	0.6583	0.6577
50	0.9957	0.9906	0.9786	0.9313	0.8458	0.7377	0.6681	0.6603
60	0.9970	0.9935	0.9850	0.9504	0.8803	0.7717	0.6793	0.6635
70	0.9978	0.9952	0.9889	0.9626	0.9053	0.8019	0.6916	0.6671
80	0.9983	0.9963	0.9915	0.9709	0.9236	0.8281	0.7046	0.6713
90	0.9987	0.9971	0.9932	0.9767	0.9374	0.8504	0.7180	0.6758
100	0.9989	0.9976	0.9945	0.9810	0.9479	0.8693	0.7316	0.6807
200	0.9997	0.9994	0.9986	0.9951	0.9857	0.9563	0.8467	0.7421
300	0.9999	0.9997	0.9994	0.9978	0.9935	0.9793	0.9103	0.8040
400	0.9999	0.9999	0.9997	0.9988	0.9963	0.9880	0.9432	0.8531
500	1.0000	0.9999	0.9998	0.9992	0.9976	0.9923	0.9614	0.8887
600	1.0000	0.9999	0.9998	0.9995	0.9984	0.9946	0.9722	0.9141
700	1.0000	1.0000	0.9999	0.9996	0.9988	0.9960	0.9792	0.9324
800	1.0000	1.0000	0.9999	0.9997	0.9991	0.9969	0.9838	0.9457
900	1.0000	1.0000	0.9999	0.9998	0.9993	0.9976	0.9871	0.9556
1000	1.0000	1.0000	0.9999	0.9998	0.9994	0.9980	0.9895	0.9631

ESQUEMA PROPOSTO

VALORES DE R1 $\theta = 0.70$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.4118	0.1667	0.0526	0.2500	0.3333	0.3793	0.4085	0.4184
3	0.5054	0.2845	0.1590	0.2595	0.3353	0.3798	0.4085	0.4185
4	0.6189	0.4142	0.2595	0.2774	0.3392	0.3806	0.4087	0.4185
5	0.7060	0.5181	0.3441	0.2991	0.3443	0.3818	0.4088	0.4185
6	0.7698	0.6006	0.4175	0.3232	0.3504	0.3833	0.4091	0.4186
7	0.8166	0.6663	0.4817	0.3488	0.3575	0.3850	0.4093	0.4187
8	0.8513	0.7189	0.5381	0.3752	0.3655	0.3870	0.4096	0.4187
9	0.8775	0.7611	0.5875	0.4018	0.3741	0.3892	0.4100	0.4188
10	0.8977	0.7952	0.6307	0.4282	0.3834	0.3917	0.4104	0.4189
20	0.9715	0.9366	0.8572	0.6499	0.4949	0.4273	0.4164	0.4204
30	0.9871	0.9705	0.9289	0.7821	0.6051	0.4765	0.4261	0.4229
40	0.9927	0.9831	0.9582	0.8567	0.6946	0.5308	0.4390	0.4263
50	0.9953	0.9891	0.9727	0.9003	0.7624	0.5845	0.4545	0.4306
60	0.9967	0.9924	0.9808	0.9273	0.8127	0.6345	0.4722	0.4358
70	0.9976	0.9944	0.9858	0.9449	0.8500	0.6793	0.4914	0.4418
80	0.9982	0.9957	0.9891	0.9569	0.8780	0.7186	0.5116	0.4485
90	0.9985	0.9966	0.9913	0.9655	0.8992	0.7527	0.5324	0.4558
100	0.9988	0.9972	0.9930	0.9717	0.9156	0.7820	0.5533	0.4638
200	0.9997	0.9993	0.9982	0.9927	0.9763	0.9235	0.7336	0.5610
300	0.9999	0.9997	0.9992	0.9967	0.9892	0.9632	0.8387	0.6591
400	0.9999	0.9998	0.9996	0.9982	0.9939	0.9787	0.8958	0.7386
500	1.0000	0.9999	0.9997	0.9988	0.9961	0.9861	0.9283	0.7983
600	1.0000	0.9999	0.9998	0.9992	0.9973	0.9903	0.9481	0.8420
700	1.0000	0.9999	0.9999	0.9994	0.9980	0.9928	0.9608	0.8741
800	1.0000	1.0000	0.9999	0.9995	0.9985	0.9945	0.9695	0.8980
900	1.0000	1.0000	0.9999	0.9996	0.9988	0.9956	0.9756	0.9160
1000	1.0000	1.0000	0.9999	0.9997	0.9990	0.9965	0.9801	0.9299

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.80 $k\Delta t$=0.00

L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.4444	0.2308	0.0476	0.1111	0.1765	0.2121	0.2346	0.2422
3	0.5219	0.3126	0.1441	0.1280	0.1796	0.2128	0.2347	0.2423
4	0.6219	0.4186	0.2362	0.1562	0.1857	0.2142	0.2349	0.2423
5	0.7026	0.5104	0.3147	0.1869	0.1935	0.2160	0.2351	0.2424
6	0.7638	0.5867	0.3838	0.2182	0.2027	0.2182	0.2355	0.2425
7	0.8098	0.6496	0.4453	0.2495	0.2130	0.2208	0.2359	0.2426
8	0.8446	0.7011	0.5001	0.2804	0.2243	0.2238	0.2363	0.2427
9	0.8712	0.7434	0.5489	0.3107	0.2362	0.2271	0.2369	0.2428
10	0.8919	0.7783	0.5923	0.3402	0.2488	0.2307	0.2375	0.2429
20	0.9694	0.9288	0.8330	0.5815	0.3855	0.2806	0.2464	0.2452
30	0.9860	0.9665	0.9150	0.7305	0.5121	0.3439	0.2605	0.2489
40	0.9921	0.9808	0.9496	0.8186	0.6151	0.4102	0.2788	0.2540
50	0.9949	0.9876	0.9669	0.8719	0.6950	0.4742	0.3001	0.2603
60	0.9965	0.9913	0.9767	0.9057	0.7558	0.5332	0.3236	0.2678
70	0.9974	0.9936	0.9827	0.9281	0.8020	0.5863	0.3484	0.2763
80	0.9980	0.9951	0.9867	0.9435	0.8373	0.6334	0.3741	0.2857
90	0.9984	0.9961	0.9894	0.9546	0.8646	0.6747	0.4000	0.2959
100	0.9987	0.9969	0.9914	0.9627	0.8859	0.7107	0.4259	0.3067
200	0.9997	0.9992	0.9978	0.9903	0.9672	0.8931	0.6448	0.4312
300	0.9999	0.9996	0.9990	0.9956	0.9850	0.9477	0.7775	0.5510
400	0.9999	0.9998	0.9995	0.9975	0.9915	0.9695	0.8531	0.6487
500	0.9999	0.9999	0.9997	0.9984	0.9945	0.9801	0.8975	0.7238
600	1.0000	0.9999	0.9998	0.9989	0.9962	0.9861	0.9252	0.7804
700	1.0000	0.9999	0.9998	0.9992	0.9972	0.9897	0.9432	0.8229
800	1.0000	1.0000	0.9999	0.9994	0.9978	0.9921	0.9556	0.8551
900	1.0000	1.0000	0.9999	0.9995	0.9983	0.9937	0.9644	0.8798
1000	1.0000	1.0000	0.9999	0.9996	0.9986	0.9949	0.9708	0.8990

ESQUEMA PROPOSTO

VALORES DE R1 θ = 0.90 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.4737	0.2857	0.1304	0.0000	0.0526	0.0811	0.0989	0.1050
3	0.5385	0.3451	0.1796	0.0576	0.0607	0.0826	0.0991	0.1050
4	0.6266	0.4307	0.2477	0.0995	0.0743	0.0854	0.0995	0.1051
5	0.7009	0.5103	0.3127	0.1364	0.0893	0.0891	0.1000	0.1052
6	0.7592	0.5795	0.3729	0.1707	0.1048	0.0935	0.1007	0.1054
7	0.8041	0.6384	0.4283	0.2033	0.1206	0.0985	0.1015	0.1056
8	0.8387	0.6879	0.4789	0.2347	0.1364	0.1039	0.1024	0.1058
9	0.8655	0.7295	0.5249	0.2649	0.1523	0.1096	0.1034	0.1061
10	0.8865	0.7643	0.5665	0.2942	0.1681	0.1158	0.1045	0.1063
20	0.9673	0.9214	0.8119	0.5339	0.3193	0.1862	0.1205	0.1105
30	0.9850	0.9627	0.9021	0.6893	0.4502	0.2611	0.1431	0.1172
40	0.9915	0.9785	0.9413	0.7858	0.5576	0.3337	0.1695	0.1260
50	0.9945	0.9861	0.9613	0.8464	0.6429	0.4017	0.1977	0.1363
60	0.9962	0.9903	0.9726	0.8857	0.7096	0.4640	0.2269	0.1480
70	0.9972	0.9928	0.9797	0.9122	0.7615	0.5203	0.2564	0.1605
80	0.9978	0.9945	0.9843	0.9307	0.8020	0.5707	0.2857	0.1738
90	0.9983	0.9956	0.9876	0.9441	0.8338	0.6154	0.3146	0.1875
100	0.9986	0.9965	0.9899	0.9540	0.8590	0.6549	0.3430	0.2017
200	0.9997	0.9991	0.9974	0.9879	0.9583	0.8655	0.5789	0.3462
300	0.9998	0.9996	0.9989	0.9946	0.9808	0.9329	0.7271	0.4758
400	0.9999	0.9998	0.9994	0.9969	0.9891	0.9605	0.8156	0.5817
500	0.9999	0.9999	0.9996	0.9980	0.9930	0.9742	0.8695	0.6650
600	1.0000	0.9999	0.9997	0.9986	0.9951	0.9819	0.9038	0.7294
700	1.0000	0.9999	0.9998	0.9990	0.9964	0.9866	0.9265	0.7790
800	1.0000	0.9999	0.9998	0.9992	0.9972	0.9897	0.9423	0.8173
900	1.0000	1.0000	0.9999	0.9994	0.9978	0.9918	0.9535	0.8473
1000	1.0000	1.0000	0.9999	0.9995	0.9982	0.9934	0.9619	0.8708

ESQUEMA PROPOSTO

VALORES DE R1 θ = 1.00 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
2	0.5000	0.3333	0.2000	0.0909	0.0476	0.0244	0.0099	0.0050
3	0.5547	0.3780	0.2294	0.1048	0.0550	0.0282	0.0114	0.0057
4	0.6325	0.4472	0.2774	0.1280	0.0673	0.0345	0.0140	0.0070
5	0.7007	0.5154	0.3281	0.1535	0.0808	0.0415	0.0168	0.0085
6	0.7559	0.5774	0.3780	0.1796	0.0949	0.0487	0.0198	0.0099
7	0.7994	0.6317	0.4257	0.2059	0.1092	0.0561	0.0228	0.0115
8	0.8335	0.6786	0.4706	0.2320	0.1236	0.0636	0.0259	0.0130
9	0.8604	0.7187	0.5125	0.2579	0.1381	0.0712	0.0289	0.0145
10	0.8817	0.7529	0.5512	0.2833	0.1525	0.0787	0.0320	0.0161
20	0.9652	0.9145	0.7937	0.5040	0.2915	0.1541	0.0632	0.0318
30	0.9840	0.9590	0.8901	0.6578	0.4150	0.2273	0.0943	0.0475
40	0.9909	0.9763	0.9334	0.7584	0.5193	0.2969	0.1252	0.0633
50	0.9941	0.9846	0.9558	0.8239	0.6047	0.3622	0.1558	0.0790
60	0.9959	0.9892	0.9687	0.8675	0.6734	0.4225	0.1859	0.0946
70	0.9970	0.9920	0.9767	0.8975	0.7282	0.4777	0.2155	0.1102
80	0.9977	0.9939	0.9820	0.9186	0.7719	0.5278	0.2445	0.1257
90	0.9982	0.9952	0.9857	0.9341	0.8069	0.5730	0.2729	0.1411
100	0.9985	0.9961	0.9884	0.9456	0.8350	0.6134	0.3006	0.1564
200	0.9996	0.9990	0.9971	0.9855	0.9498	0.8408	0.5333	0.3020
300	0.9998	0.9996	0.9987	0.9935	0.9767	0.9189	0.6870	0.4291
400	0.9999	0.9998	0.9993	0.9963	0.9867	0.9519	0.7835	0.5351
500	0.9999	0.9998	0.9995	0.9976	0.9914	0.9684	0.8443	0.6208
600	1.0000	0.9999	0.9997	0.9984	0.9940	0.9777	0.8840	0.6888
700	1.0000	0.9999	0.9998	0.9988	0.9956	0.9835	0.9108	0.7425
800	1.0000	0.9999	0.9998	0.9991	0.9966	0.9873	0.9296	0.7849
900	1.0000	1.0000	0.9999	0.9993	0.9973	0.9899	0.9431	0.8186
1000	1.0000	1.0000	0.9999	0.9994	0.9978	0.9918	0.9532	0.8455

ESQUEMA PROPOSTO

VALORES DE R2 θ = 0.20 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.7533	0.9474	0.6146	0.2740	0.1427	0.0730	0.0297	0.0149
4	0.8641	0.9492	0.7028	0.3410	0.1832	0.0955	0.0392	0.0198
5	0.9116	0.9589	0.7678	0.4006	0.2213	0.1172	0.0487	0.0247
6	0.9376	0.9676	0.8157	0.4537	0.2572	0.1383	0.0580	0.0295
7	0.9536	0.9743	0.8514	0.5008	0.2908	0.1586	0.0672	0.0343
8	0.9642	0.9792	0.8783	0.5429	0.3224	0.1784	0.0763	0.0391
9	0.9715	0.9830	0.8990	0.5804	0.3521	0.1974	0.0853	0.0438
10	0.9768	0.9859	0.9150	0.6141	0.3800	0.2159	0.0941	0.0485
20	0.9941	0.9962	0.9756	0.8152	0.5864	0.3707	0.1763	0.0939
30	0.9974	0.9983	0.9889	0.8974	0.7111	0.4848	0.2479	0.1363
40	0.9985	0.9990	0.9937	0.9363	0.7913	0.5723	0.3104	0.1758
50	0.9991	0.9994	0.9959	0.9571	0.8445	0.6415	0.3653	0.2126
60	0.9993	0.9996	0.9972	0.9694	0.8809	0.6970	0.4139	0.2470
70	0.9995	0.9997	0.9979	0.9771	0.9065	0.7420	0.4573	0.2791
80	0.9996	0.9998	0.9984	0.9822	0.9251	0.7787	0.4963	0.3091
90	0.9997	0.9998	0.9987	0.9858	0.9388	0.8090	0.5316	0.3371
100	0.9998	0.9998	0.9990	0.9885	0.9491	0.8340	0.5638	0.3635
200	0.9999	1.0000	0.9997	0.9971	0.9861	0.9448	0.7711	0.5609
300	1.0000	1.0000	0.9999	0.9987	0.9937	0.9737	0.8667	0.6854
400	1.0000	1.0000	0.9999	0.9993	0.9965	0.9849	0.9152	0.7685
500	1.0000	1.0000	1.0000	0.9995	0.9977	0.9902	0.9421	0.8253
600	1.0000	1.0000	1.0000	0.9997	0.9984	0.9931	0.9582	0.8649
700	1.0000	1.0000	1.0000	0.9998	0.9988	0.9949	0.9686	0.8932
800	1.0000	1.0000	1.0000	0.9998	0.9991	0.9961	0.9756	0.9139
900	1.0000	1.0000	1.0000	0.9999	0.9993	0.9969	0.9805	0.9294
1000	1.0000	1.0000	1.0000	0.9999	0.9994	0.9975	0.9841	0.9412

ESQUEMA PROPOSTO

VALORES DE R2 $\theta = 0.30$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.6433	0.8739	0.6146	0.2772	0.1440	0.0734	0.0297	0.0149
4	0.7940	0.8866	0.7028	0.3478	0.1861	0.0964	0.0394	0.0198
5	0.8630	0.9097	0.7678	0.4114	0.2262	0.1188	0.0490	0.0247
6	0.9021	0.9289	0.8157	0.4683	0.2642	0.1406	0.0585	0.0296
7	0.9266	0.9434	0.8514	0.5191	0.3002	0.1619	0.0678	0.0345
8	0.9430	0.9543	0.8783	0.5643	0.3343	0.1826	0.0771	0.0393
9	0.9545	0.9624	0.8990	0.6046	0.3666	0.2028	0.0863	0.0441
10	0.9629	0.9687	0.9150	0.6404	0.3971	0.2225	0.0954	0.0488
20	0.9905	0.9914	0.9756	0.8433	0.6225	0.3915	0.1814	0.0953
30	0.9957	0.9961	0.9889	0.9173	0.7512	0.5183	0.2585	0.1393
40	0.9976	0.9978	0.9937	0.9500	0.8278	0.6136	0.3273	0.1811
50	0.9985	0.9986	0.9959	0.9668	0.8757	0.6861	0.3886	0.2207
60	0.9989	0.9990	0.9972	0.9765	0.9069	0.7418	0.4431	0.2580
70	0.9992	0.9993	0.9979	0.9825	0.9281	0.7852	0.4917	0.2933
80	0.9994	0.9994	0.9984	0.9865	0.9430	0.8194	0.5350	0.3266
90	0.9995	0.9996	0.9987	0.9893	0.9538	0.8467	0.5737	0.3580
100	0.9996	0.9996	0.9990	0.9913	0.9619	0.8686	0.6083	0.3877
200	0.9999	0.9999	0.9997	0.9978	0.9899	0.9591	0.8141	0.6065
300	1.0000	1.0000	0.9999	0.9990	0.9954	0.9809	0.8973	0.7340
400	1.0000	1.0000	0.9999	0.9994	0.9974	0.9890	0.9364	0.8123
500	1.0000	1.0000	1.0000	0.9996	0.9983	0.9929	0.9573	0.8626
600	1.0000	1.0000	1.0000	0.9998	0.9989	0.9951	0.9695	0.8960
700	1.0000	1.0000	1.0000	0.9998	0.9992	0.9964	0.9772	0.9191
800	1.0000	1.0000	1.0000	0.9999	0.9994	0.9972	0.9823	0.9355
900	1.0000	1.0000	1.0000	0.9999	0.9995	0.9978	0.9859	0.9476
1000	1.0000	1.0000	1.0000	0.9999	0.9996	0.9982	0.9885	0.9566

ESQUEMA PROPOSTO

VALORES DE R2 $\theta = 0.40$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.5479	0.7610	0.6045	0.2780	0.1444	0.0736	0.0298	0.0149
4	0.7258	0.8028	0.6857	0.3497	0.1872	0.0967	0.0395	0.0199
5	0.8134	0.8453	0.7472	0.4145	0.2280	0.1194	0.0491	0.0248
6	0.8648	0.8781	0.7940	0.4726	0.2669	0.1416	0.0586	0.0297
7	0.8977	0.9026	0.8300	0.5246	0.3040	0.1632	0.0681	0.0345
8	0.9201	0.9210	0.8581	0.5709	0.3391	0.1844	0.0775	0.0394
9	0.9359	0.9349	0.8803	0.6121	0.3725	0.2050	0.0868	0.0442
10	0.9475	0.9455	0.8979	0.6487	0.4041	0.2252	0.0960	0.0490
20	0.9864	0.9848	0.9690	0.8528	0.6394	0.4008	0.1835	0.0958
30	0.9939	0.9931	0.9856	0.9241	0.7713	0.5346	0.2630	0.1406
40	0.9966	0.9961	0.9918	0.9547	0.8466	0.6350	0.3347	0.1833
50	0.9978	0.9975	0.9947	0.9701	0.8917	0.7103	0.3993	0.2240
60	0.9985	0.9983	0.9963	0.9789	0.9202	0.7668	0.4571	0.2627
70	0.9989	0.9987	0.9973	0.9843	0.9391	0.8098	0.5087	0.2995
80	0.9991	0.9990	0.9979	0.9879	0.9522	0.8427	0.5548	0.3344
90	0.9993	0.9992	0.9983	0.9904	0.9615	0.8683	0.5959	0.3675
100	0.9994	0.9994	0.9987	0.9922	0.9684	0.8885	0.6325	0.3988
200	0.9999	0.9998	0.9997	0.9980	0.9917	0.9672	0.8401	0.6316
300	0.9999	0.9999	0.9999	0.9991	0.9963	0.9849	0.9158	0.7630
400	1.0000	1.0000	0.9999	0.9995	0.9979	0.9914	0.9492	0.8392
500	1.0000	1.0000	0.9999	0.9997	0.9987	0.9945	0.9663	0.8855
600	1.0000	1.0000	1.0000	0.9998	0.9991	0.9961	0.9761	0.9152
700	1.0000	1.0000	1.0000	0.9998	0.9993	0.9972	0.9822	0.9350
800	1.0000	1.0000	1.0000	0.9999	0.9995	0.9978	0.9863	0.9487
900	1.0000	1.0000	1.0000	0.9999	0.9996	0.9983	0.9891	0.9586
1000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9986	0.9911	0.9660

ESQUEMA PROPOSTO

VALORES DE R2 $\theta = 0.50$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.4676	0.6158	0.5796	0.2772	0.1444	0.0736	0.0298	0.0149
4	0.6610	0.7048	0.6476	0.3478	0.1872	0.0968	0.0395	0.0199
5	0.7638	0.7703	0.7039	0.4114	0.2280	0.1195	0.0491	0.0248
6	0.8264	0.8184	0.7500	0.4683	0.2669	0.1417	0.0587	0.0297
7	0.8674	0.8541	0.7877	0.5191	0.3040	0.1634	0.0681	0.0345
8	0.8957	0.8809	0.8186	0.5643	0.3391	0.1847	0.0775	0.0394
9	0.9159	0.9013	0.8439	0.6046	0.3725	0.2054	0.0869	0.0442
10	0.9309	0.9171	0.8648	0.6404	0.4041	0.2256	0.0961	0.0490
20	0.9818	0.9765	0.9560	0.8433	0.6394	0.4025	0.1840	0.0960
30	0.9918	0.9893	0.9792	0.9173	0.7713	0.5376	0.2641	0.1409
40	0.9954	0.9939	0.9880	0.9500	0.8466	0.6392	0.3366	0.1839
50	0.9970	0.9961	0.9923	0.9668	0.8917	0.7150	0.4020	0.2249
60	0.9979	0.9973	0.9946	0.9765	0.9202	0.7718	0.4607	0.2640
70	0.9985	0.9980	0.9960	0.9825	0.9391	0.8147	0.5132	0.3012
80	0.9988	0.9985	0.9969	0.9865	0.9522	0.8474	0.5601	0.3365
90	0.9991	0.9988	0.9976	0.9893	0.9615	0.8727	0.6019	0.3701
100	0.9993	0.9990	0.9980	0.9913	0.9684	0.8926	0.6391	0.4019
200	0.9998	0.9998	0.9995	0.9978	0.9917	0.9688	0.8476	0.6391
300	0.9999	0.9999	0.9998	0.9990	0.9963	0.9857	0.9212	0.7720
400	1.0000	0.9999	0.9999	0.9994	0.9979	0.9919	0.9529	0.8477
500	1.0000	1.0000	0.9999	0.9996	0.9987	0.9948	0.9689	0.8928
600	1.0000	1.0000	0.9999	0.9998	0.9991	0.9964	0.9780	0.9212
700	1.0000	1.0000	1.0000	0.9998	0.9993	0.9973	0.9837	0.9400
800	1.0000	1.0000	1.0000	0.9999	0.9995	0.9979	0.9874	0.9529
900	1.0000	1.0000	1.0000	0.9999	0.9996	0.9984	0.9900	0.9621
1000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9987	0.9919	0.9689

ESQUEMA PROPOSTO

VALORES DE R2 $\theta = 0.60$ $k\Delta t = 0.00$

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.4009	0.4682	0.5269	0.2740	0.1440	0.0735	0.0298	0.0149
4	0.6007	0.6027	0.5810	0.3410	0.1861	0.0966	0.0395	0.0199
5	0.7151	0.6903	0.6355	0.4006	0.2262	0.1192	0.0491	0.0248
6	0.7875	0.7533	0.6843	0.4537	0.2642	0.1412	0.0586	0.0297
7	0.8361	0.8002	0.7263	0.5008	0.3002	0.1627	0.0681	0.0345
8	0.8701	0.8357	0.7620	0.5429	0.3343	0.1837	0.0774	0.0394
9	0.8948	0.8631	0.7922	0.5804	0.3666	0.2042	0.0867	0.0442
10	0.9132	0.8844	0.8178	0.6141	0.3971	0.2241	0.0959	0.0490
20	0.9769	0.9665	0.9370	0.8152	0.6225	0.3972	0.1832	0.0958
30	0.9896	0.9846	0.9697	0.8974	0.7512	0.5282	0.2624	0.1405
40	0.9941	0.9912	0.9825	0.9363	0.8278	0.6266	0.3338	0.1832
50	0.9962	0.9944	0.9886	0.9571	0.8757	0.7007	0.3978	0.2238
60	0.9974	0.9961	0.9920	0.9694	0.9069	0.7568	0.4552	0.2624
70	0.9981	0.9971	0.9941	0.9771	0.9281	0.7999	0.5064	0.2991
80	0.9985	0.9978	0.9955	0.9822	0.9430	0.8333	0.5521	0.3339
90	0.9988	0.9983	0.9964	0.9858	0.9538	0.8596	0.5928	0.3669
100	0.9991	0.9986	0.9971	0.9885	0.9619	0.8805	0.6291	0.3981
200	0.9998	0.9996	0.9993	0.9971	0.9899	0.9639	0.8364	0.6299
300	0.9999	0.9998	0.9997	0.9987	0.9954	0.9833	0.9131	0.7610
400	0.9999	0.9999	0.9998	0.9993	0.9974	0.9904	0.9473	0.8373
500	1.0000	0.9999	0.9999	0.9995	0.9983	0.9938	0.9650	0.8839
600	1.0000	1.0000	0.9999	0.9997	0.9989	0.9957	0.9752	0.9138
700	1.0000	1.0000	0.9999	0.9998	0.9992	0.9968	0.9815	0.9338
800	1.0000	1.0000	1.0000	0.9998	0.9994	0.9976	0.9857	0.9478
900	1.0000	1.0000	1.0000	0.9999	0.9995	0.9981	0.9886	0.9579
1000	1.0000	1.0000	1.0000	0.9999	0.9996	0.9984	0.9908	0.9653

ESQUEMA PROPOSTO

VALORES DE R2 $\theta = 0.70$ $k\Delta t = 0.00$

L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.3459	0.3480	0.4186	0.2663	0.1427	0.0733	0.0297	0.0149
4	0.5454	0.5064	0.4809	0.3251	0.1832	0.0960	0.0394	0.0198
5	0.6680	0.6106	0.5441	0.3770	0.2213	0.1182	0.0489	0.0247
6	0.7486	0.6863	0.6007	0.4230	0.2572	0.1397	0.0584	0.0296
7	0.8041	0.7434	0.6499	0.4642	0.2908	0.1606	0.0678	0.0344
8	0.8437	0.7872	0.6923	0.5015	0.3224	0.1810	0.0770	0.0393
9	0.8727	0.8214	0.7287	0.5355	0.3521	0.2007	0.0862	0.0441
10	0.8945	0.8484	0.7599	0.5665	0.3800	0.2199	0.0953	0.0488
20	0.9715	0.9549	0.9127	0.7699	0.5864	0.3830	0.1807	0.0952
30	0.9871	0.9792	0.9573	0.8655	0.7111	0.5041	0.2570	0.1391
40	0.9927	0.9881	0.9751	0.9142	0.7913	0.5957	0.3249	0.1808
50	0.9953	0.9924	0.9838	0.9414	0.8445	0.6664	0.3852	0.2201
60	0.9967	0.9947	0.9886	0.9577	0.8809	0.7218	0.4387	0.2573
70	0.9976	0.9961	0.9916	0.9681	0.9065	0.7658	0.4864	0.2923
80	0.9982	0.9970	0.9935	0.9752	0.9251	0.8011	0.5289	0.3254
90	0.9986	0.9976	0.9949	0.9802	0.9388	0.8297	0.5670	0.3566
100	0.9988	0.9981	0.9958	0.9838	0.9491	0.8530	0.6011	0.3860
200	0.9997	0.9995	0.9990	0.9958	0.9861	0.9527	0.8068	0.6029
300	0.9999	0.9998	0.9995	0.9981	0.9937	0.9777	0.8921	0.7300
400	0.9999	0.9999	0.9997	0.9990	0.9965	0.9872	0.9328	0.8087
500	1.0000	0.9999	0.9998	0.9993	0.9977	0.9917	0.9547	0.8594
600	1.0000	0.9999	0.9999	0.9995	0.9984	0.9942	0.9676	0.8934
700	1.0000	1.0000	0.9999	0.9997	0.9988	0.9957	0.9757	0.9169
800	1.0000	1.0000	0.9999	0.9997	0.9991	0.9967	0.9812	0.9337
900	1.0000	1.0000	0.9999	0.9998	0.9993	0.9974	0.9850	0.9461
1000	1.0000	1.0000	1.0000	0.9998	0.9994	0.9979	0.9878	0.9553

ESQUEMA PROPOSTO

VALORES DE R2 θ = 0.80 $k\Delta t$=0.00

	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.3006	0.2615	0.2628	0.2439	0.1393	0.0726	0.0296	0.0149
4	0.4952	0.4222	0.3628	0.2859	0.1758	0.0945	0.0392	0.0198
5	0.6231	0.5354	0.4416	0.3258	0.2093	0.1156	0.0486	0.0247
6	0.7104	0.6204	0.5084	0.3637	0.2403	0.1359	0.0579	0.0295
7	0.7720	0.6858	0.5657	0.3995	0.2690	0.1554	0.0670	0.0343
8	0.8166	0.7370	0.6153	0.4333	0.2958	0.1742	0.0760	0.0390
9	0.8498	0.7775	0.6581	0.4651	0.3208	0.1923	0.0849	0.0437
10	0.8750	0.8100	0.6951	0.4951	0.3445	0.2096	0.0937	0.0484
20	0.9657	0.9418	0.8838	0.7105	0.5280	0.3531	0.1746	0.0936
30	0.9845	0.9730	0.9423	0.8235	0.6522	0.4594	0.2445	0.1358
40	0.9912	0.9845	0.9661	0.8847	0.7390	0.5433	0.3051	0.1749
50	0.9943	0.9900	0.9778	0.9200	0.8002	0.6115	0.3583	0.2114
60	0.9961	0.9930	0.9844	0.9417	0.8439	0.6676	0.4054	0.2453
70	0.9971	0.9949	0.9885	0.9559	0.8757	0.7140	0.4476	0.2769
80	0.9978	0.9961	0.9911	0.9655	0.8992	0.7526	0.4858	0.3064
90	0.9982	0.9969	0.9930	0.9724	0.9169	0.7848	0.5205	0.3341
100	0.9986	0.9975	0.9943	0.9774	0.9305	0.8118	0.5522	0.3600
200	0.9996	0.9994	0.9986	0.9941	0.9806	0.9355	0.7606	0.5551
300	0.9998	0.9997	0.9994	0.9974	0.9912	0.9690	0.8593	0.6795
400	0.9999	0.9998	0.9996	0.9985	0.9950	0.9821	0.9100	0.7633
500	0.9999	0.9999	0.9998	0.9991	0.9968	0.9884	0.9384	0.8208
600	1.0000	0.9999	0.9998	0.9993	0.9978	0.9919	0.9555	0.8612
700	1.0000	0.9999	0.9999	0.9995	0.9984	0.9940	0.9665	0.8901
800	1.0000	1.0000	0.9999	0.9996	0.9987	0.9954	0.9739	0.9113
900	1.0000	1.0000	0.9999	0.9997	0.9990	0.9963	0.9791	0.9272
1000	1.0000	1.0000	0.9999	0.9998	0.9992	0.9970	0.9829	0.9393

ESQUEMA PROPOSTO

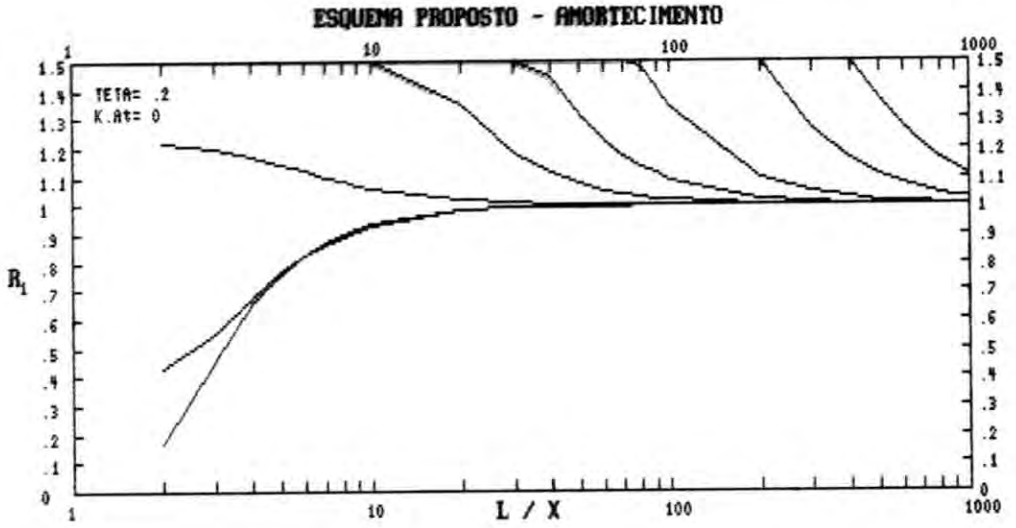
VALORES DE R2 $\theta = 0.90$ $k\Delta t = 0.00$

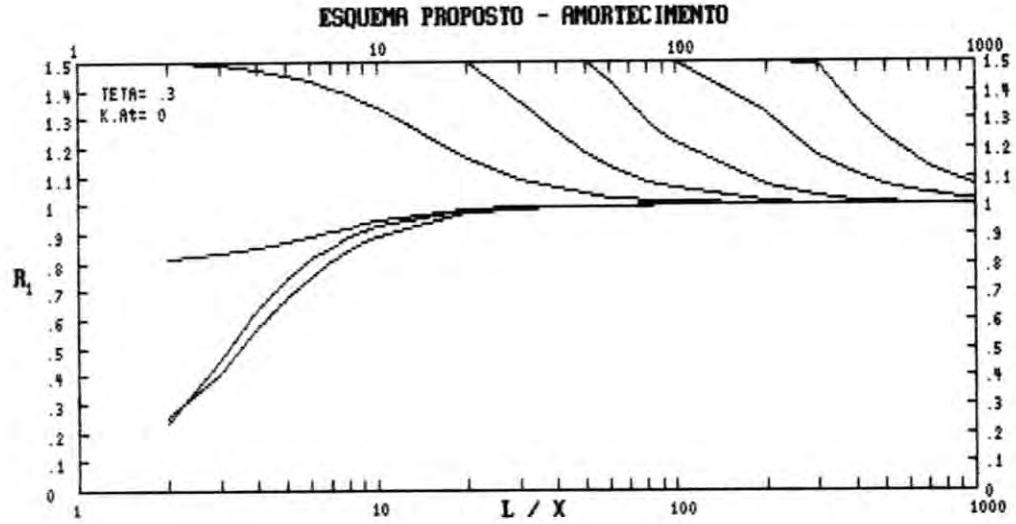
	c $\Delta t/\Delta x$							
L/Δx	0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.2630	0.2014	0.1531	0.1445	0.1235	0.0701	0.0293	0.0148
4	0.4501	0.3521	0.2598	0.1873	0.1467	0.0889	0.0385	0.0196
5	0.5805	0.4674	0.3458	0.2282	0.1692	0.1064	0.0473	0.0244
6	0.6730	0.5578	0.4188	0.2672	0.1913	0.1228	0.0560	0.0290
7	0.7399	0.6294	0.4821	0.3044	0.2129	0.1382	0.0644	0.0337
8	0.7892	0.6866	0.5372	0.3397	0.2339	0.1527	0.0727	0.0382
9	0.8264	0.7327	0.5854	0.3732	0.2544	0.1666	0.0806	0.0427
10	0.8549	0.7701	0.6275	0.4050	0.2744	0.1799	0.0884	0.0472
20	0.9595	0.9275	0.8513	0.6415	0.4479	0.2937	0.1566	0.0887
30	0.9816	0.9660	0.9248	0.7738	0.5783	0.3878	0.2124	0.1253
40	0.9896	0.9805	0.9555	0.8490	0.6747	0.4685	0.2608	0.1580
50	0.9933	0.9874	0.9708	0.8938	0.7456	0.5378	0.3045	0.1876
60	0.9953	0.9912	0.9794	0.9219	0.7980	0.5971	0.3447	0.2148
70	0.9966	0.9935	0.9847	0.9405	0.8370	0.6478	0.3821	0.2401
80	0.9974	0.9950	0.9883	0.9533	0.8665	0.6911	0.4171	0.2639
90	0.9979	0.9961	0.9907	0.9625	0.8891	0.7280	0.4499	0.2864
100	0.9983	0.9968	0.9924	0.9692	0.9067	0.7596	0.4807	0.3080
200	0.9996	0.9992	0.9981	0.9920	0.9733	0.9129	0.7008	0.4847
300	0.9998	0.9996	0.9992	0.9964	0.9878	0.9575	0.8168	0.6120
400	0.9999	0.9998	0.9995	0.9980	0.9931	0.9752	0.8800	0.7040
500	0.9999	0.9999	0.9997	0.9987	0.9955	0.9839	0.9166	0.7706
600	1.0000	0.9999	0.9998	0.9991	0.9969	0.9887	0.9392	0.8191
700	1.0000	0.9999	0.9998	0.9993	0.9977	0.9916	0.9539	0.8548
800	1.0000	1.0000	0.9999	0.9995	0.9982	0.9936	0.9640	0.8816
900	1.0000	1.0000	0.9999	0.9996	0.9986	0.9949	0.9711	0.9020
1000	1.0000	1.0000	0.9999	0.9997	0.9989	0.9959	0.9763	0.9178

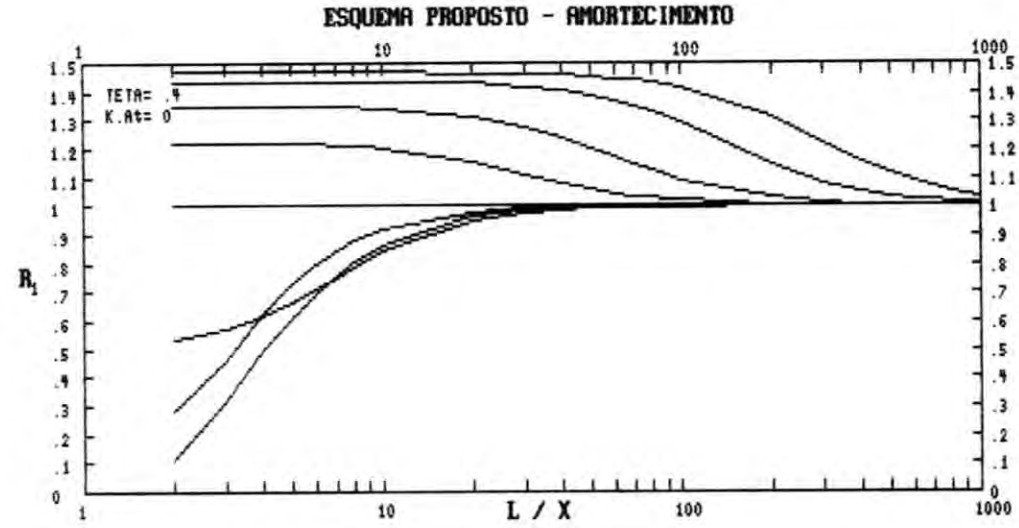
ESQUEMA PROPOSTO

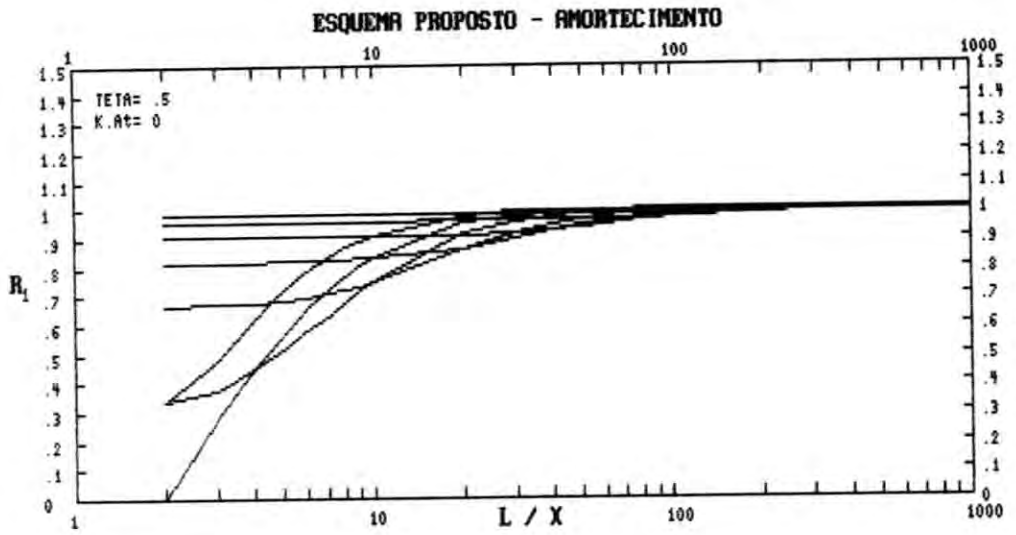
VALORES DE R2 $\theta = 1.00$ $k\Delta t = 0.00$

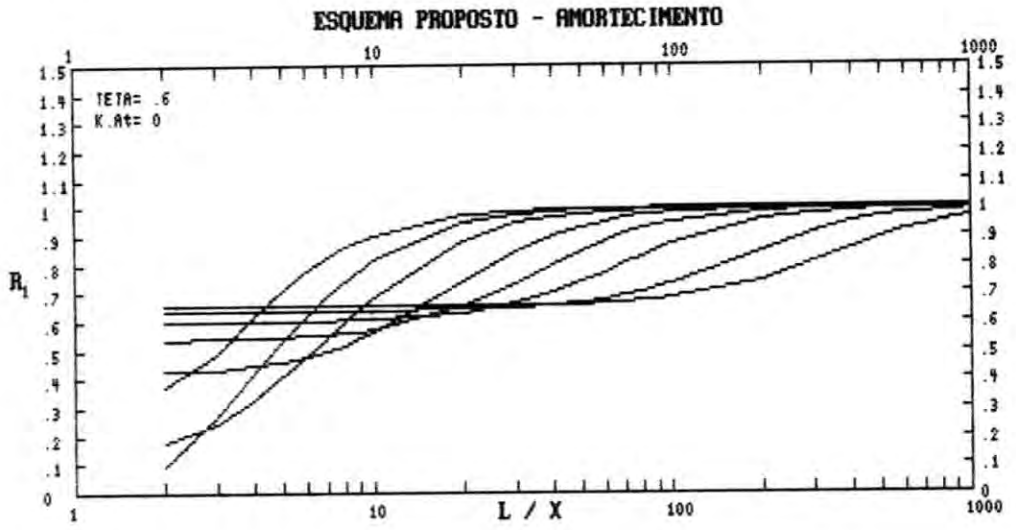
L/Δx	c Δt/Δx = 0.5	1.0	2.0	5.0	10.0	20.0	50.0	100.0
3	0.2316	0.1592	0.0976	0.0450	0.0237	0.0122	0.0049	0.0025
4	0.4097	0.2952	0.1872	0.0885	0.0470	0.0242	0.0099	0.0050
5	0.5407	0.4077	0.2681	0.1302	0.0698	0.0362	0.0148	0.0074
6	0.6369	0.5000	0.3408	0.1702	0.0921	0.0480	0.0197	0.0099
7	0.7082	0.5755	0.4057	0.2084	0.1140	0.0597	0.0245	0.0124
8	0.7617	0.6372	0.4636	0.2450	0.1354	0.0713	0.0294	0.0148
9	0.8026	0.6879	0.5151	0.2799	0.1564	0.0827	0.0342	0.0173
10	0.8343	0.7297	0.5609	0.3132	0.1768	0.0940	0.0390	0.0198
20	0.9530	0.9119	0.8160	0.5683	0.3570	0.2007	0.0860	0.0440
30	0.9785	0.9584	0.9051	0.7190	0.4969	0.2956	0.1310	0.0677
40	0.9878	0.9761	0.9433	0.8085	0.6036	0.3793	0.1741	0.0910
50	0.9922	0.9845	0.9627	0.8635	0.6844	0.4528	0.2152	0.1137
60	0.9945	0.9892	0.9736	0.8988	0.7457	0.5170	0.2543	0.1360
70	0.9960	0.9920	0.9804	0.9224	0.7924	0.5729	0.2917	0.1577
80	0.9969	0.9939	0.9849	0.9388	0.8284	0.6213	0.3271	0.1790
90	0.9976	0.9952	0.9880	0.9507	0.8563	0.6633	0.3609	0.1997
100	0.9980	0.9961	0.9903	0.9594	0.8784	0.6998	0.3928	0.2200
200	0.9995	0.9990	0.9975	0.9893	0.9643	0.8857	0.6320	0.3974
300	0.9998	0.9996	0.9989	0.9952	0.9836	0.9432	0.7668	0.5332
400	0.9999	0.9998	0.9994	0.9973	0.9907	0.9666	0.8439	0.6355
500	0.9999	0.9998	0.9996	0.9983	0.9940	0.9782	0.8900	0.7121
600	0.9999	0.9999	0.9997	0.9988	0.9958	0.9847	0.9191	0.7694
700	1.0000	0.9999	0.9998	0.9991	0.9969	0.9887	0.9383	0.8127
800	1.0000	0.9999	0.9998	0.9993	0.9976	0.9913	0.9515	0.8458
900	1.0000	1.0000	0.9999	0.9995	0.9981	0.9931	0.9610	0.8714
1000	1.0000	1.0000	0.9999	0.9996	0.9985	0.9944	0.9680	0.8914

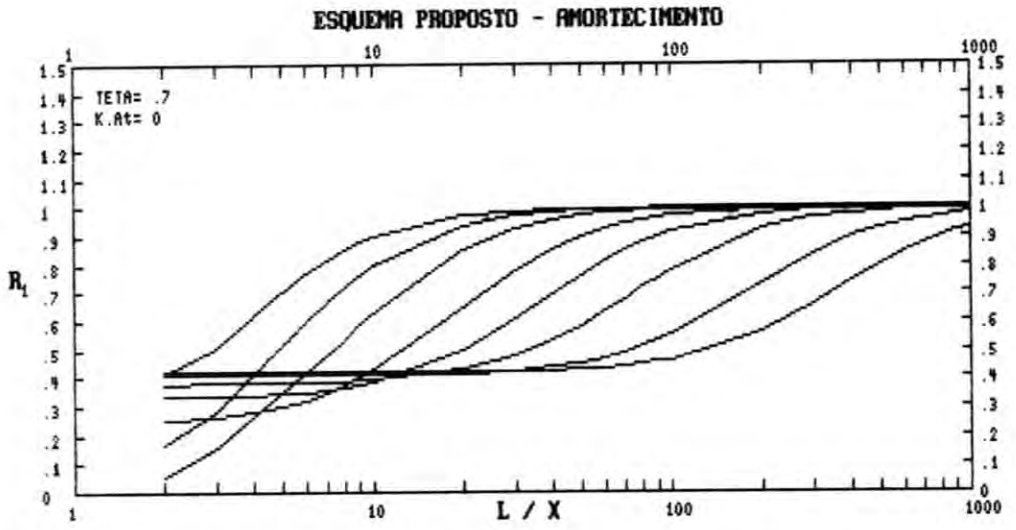

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .2
K.At= 0
R1
L / X

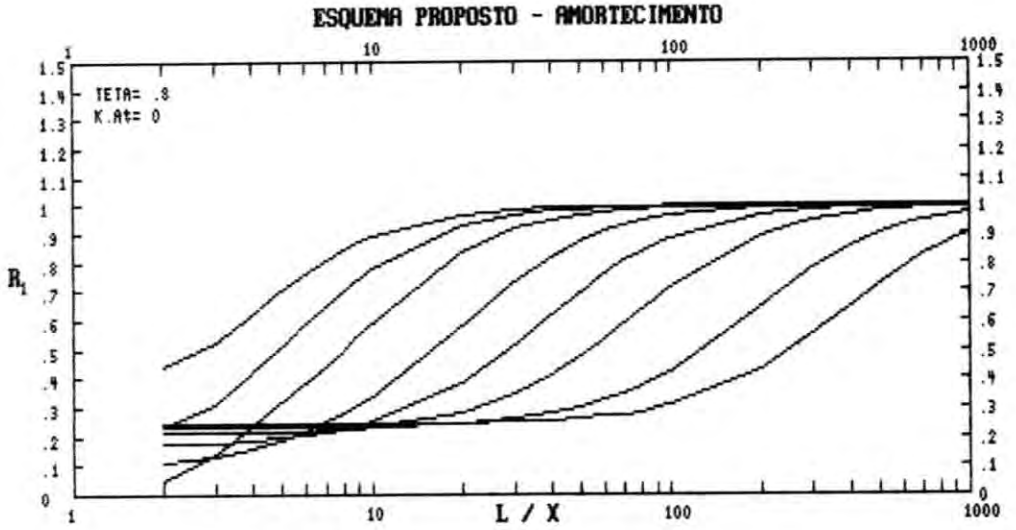

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .3
K.At= 0
R1
L / X

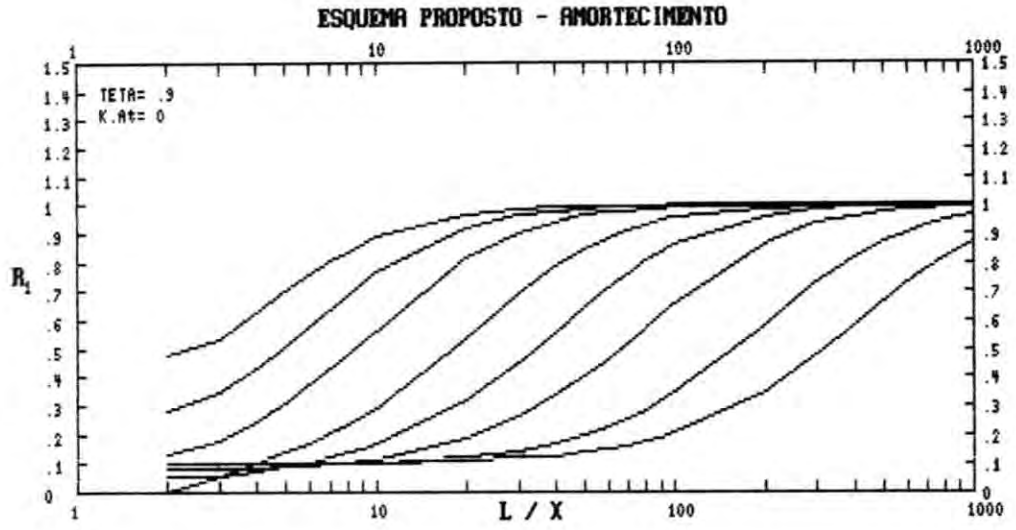

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .4
K.At= 0
R1
L / X

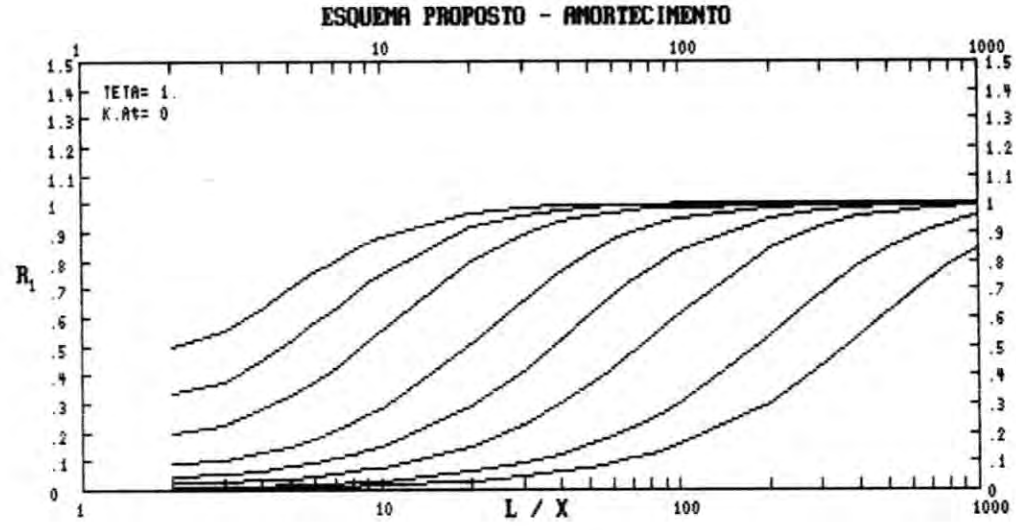

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .5
K.At= 0
R1
L / X

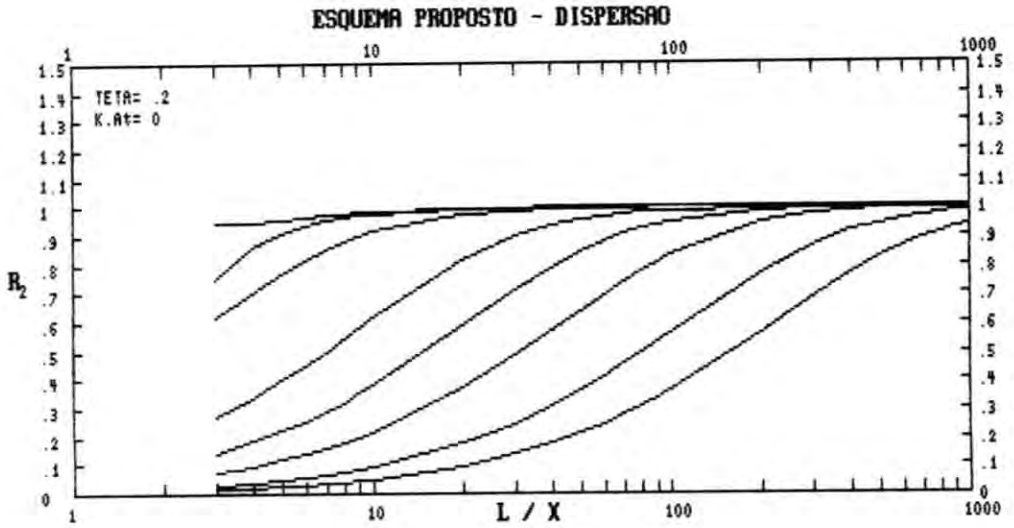

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .6
K.At= 0
R1
L / X

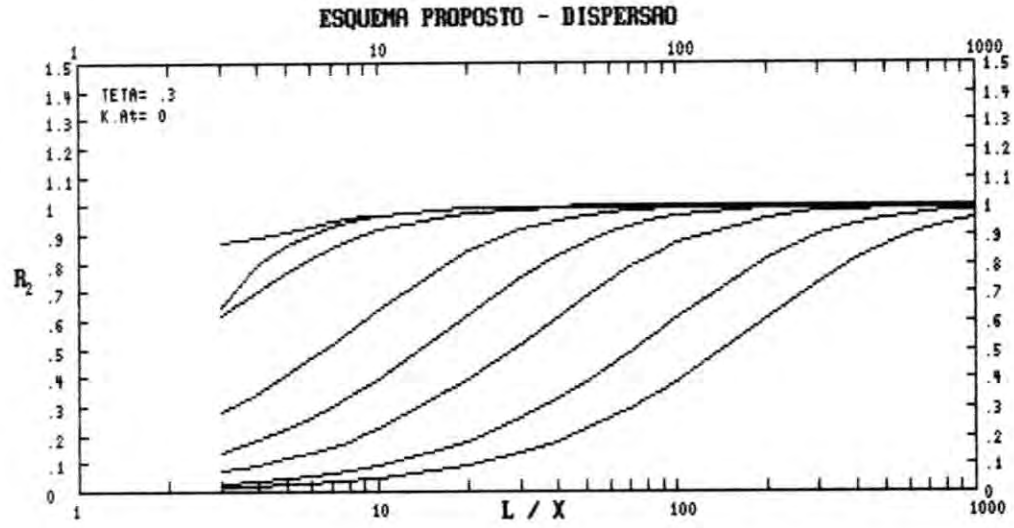

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .7
K.At= 0
R1
L / X

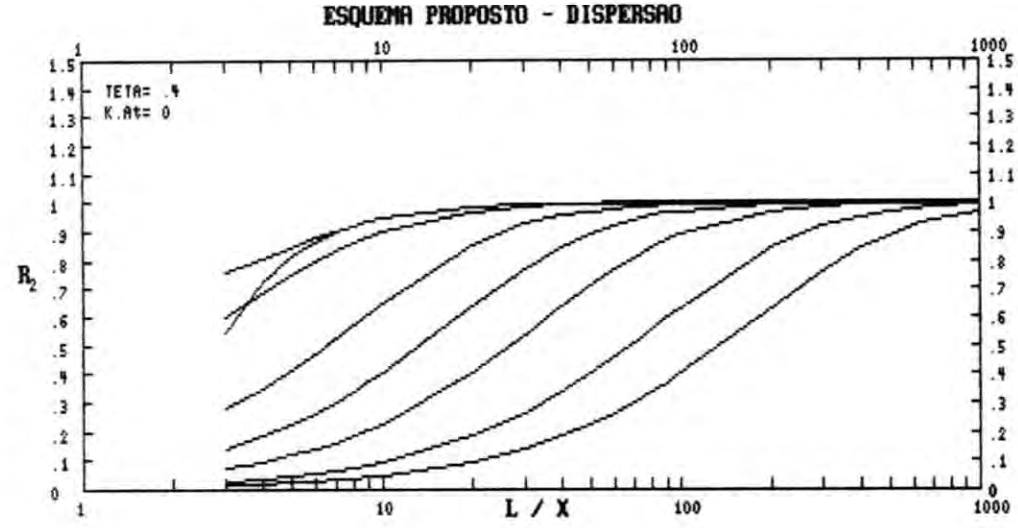

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .8
K.At= 0
R1
L / X

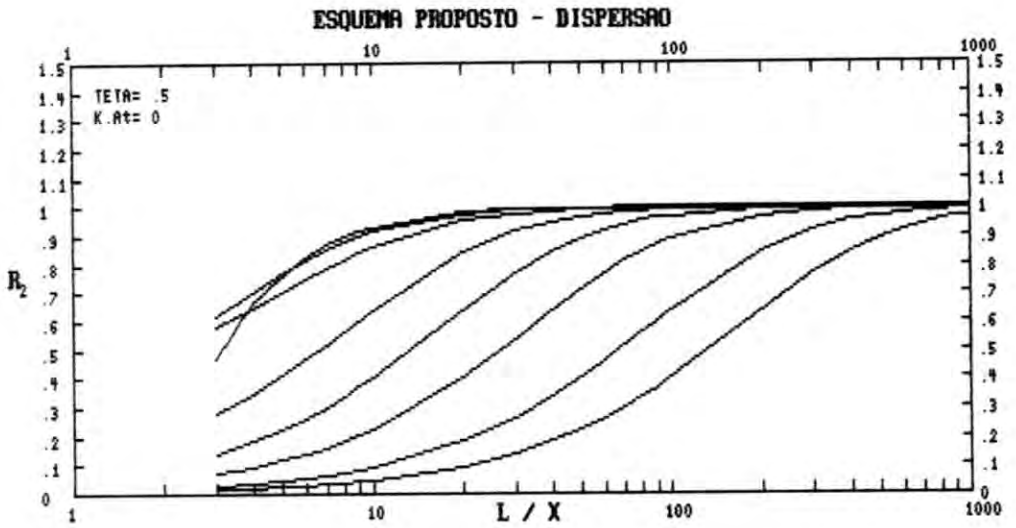

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= .9
K.At= 0
R1
L / X

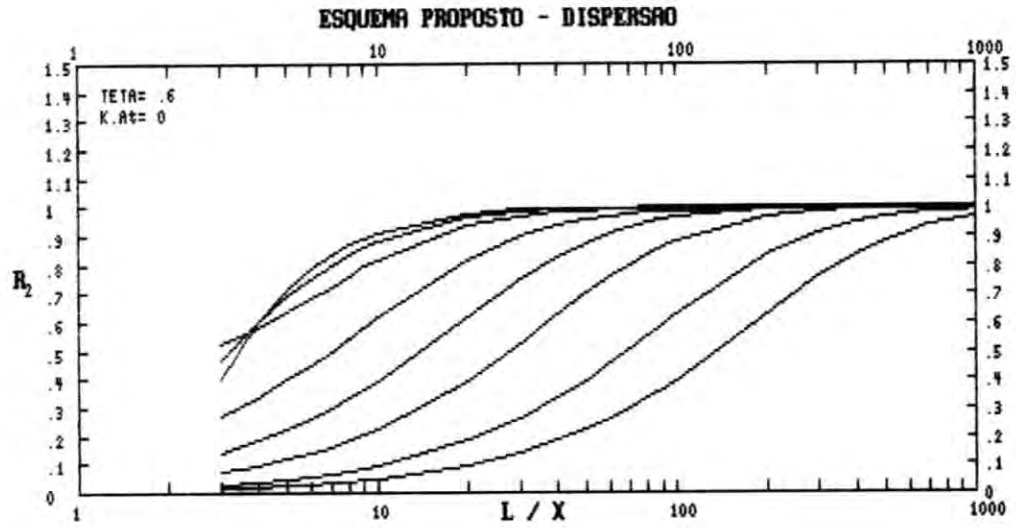

ESQUEMA PROPOSTO - AMORTECIMENTO
TETA= 1.
K.At= 0
R1
L / X

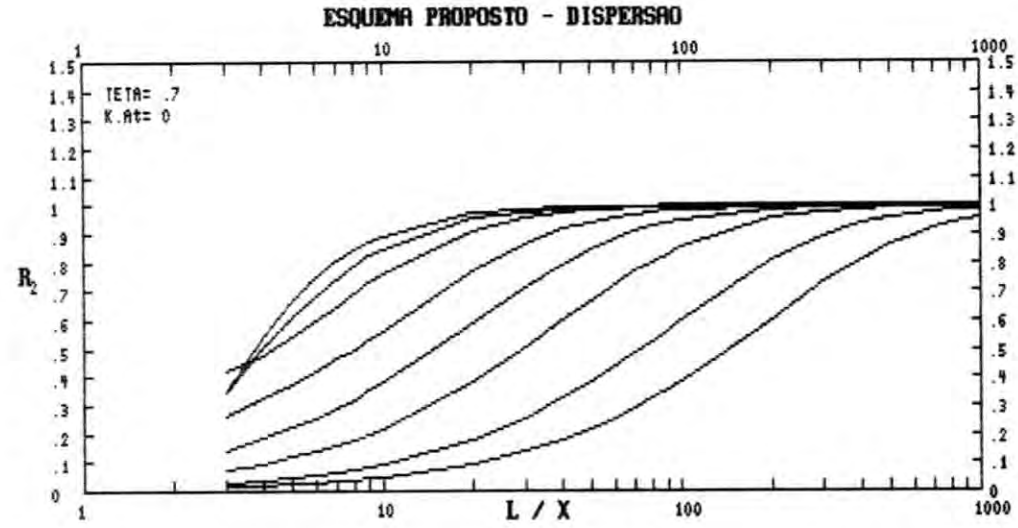

ESQUEMA PROPOSTO - DISPERSAO
TETA= .2
K.At= 0
R2
L / X

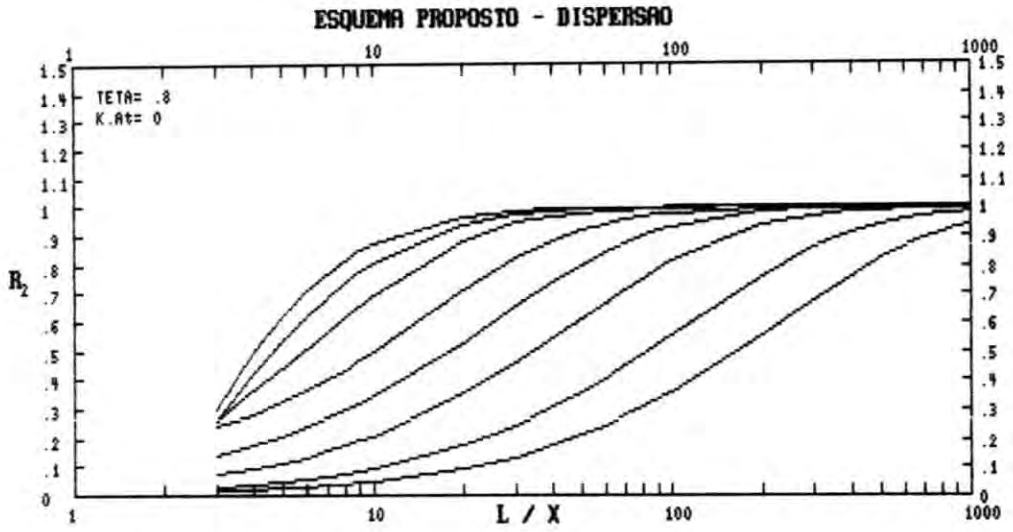

ESQUEMA PROPOSTO - DISPERSAO
TETA= .3
K.At= 0
R2
L / X

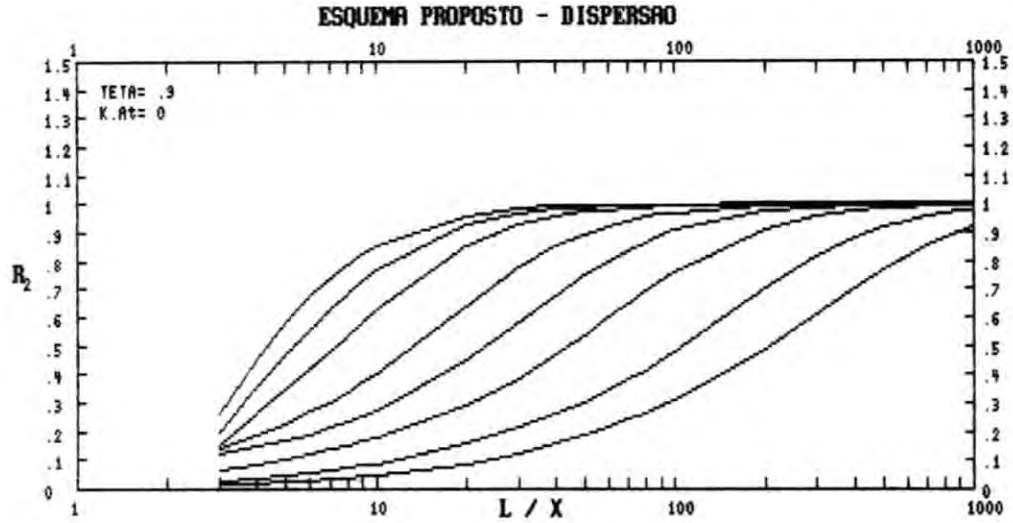

ESQUEMA PROPOSTO - DISPERSAO
TETA= .4
K.At= 0
R2
L / X

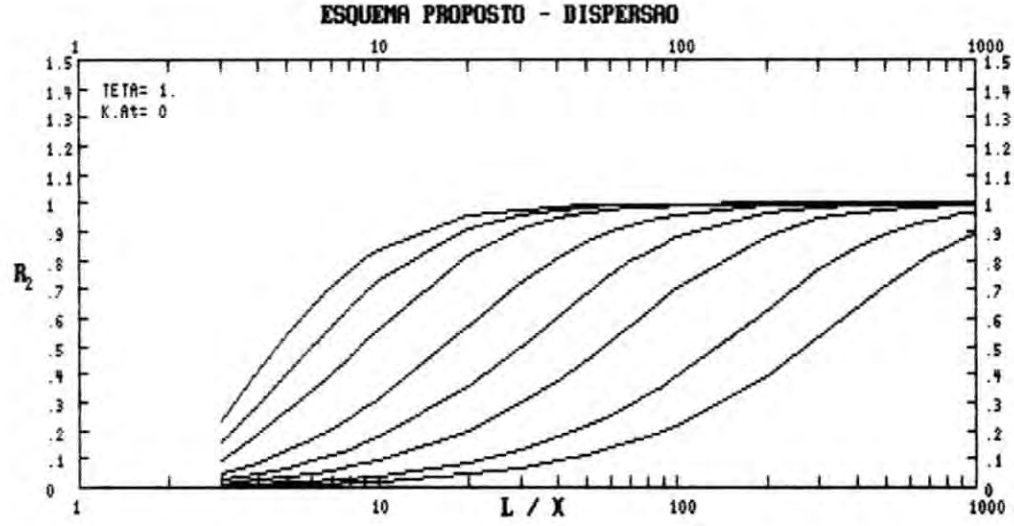

ESQUEMA PROPOSTO - DISPERSAO
TETA= .5
K.At= 0
R2
L / X


ESQUEMA PROPOSTO - DISPERSAO
TETA= .6
K.At= 0
R2
L / X


ESQUEMA PROPOSTO - DISPERSAO
TETA= .7
K.At= 0
R2
L / X


ESQUEMA PROPOSTO - DISPERSAO
TETA= .8
K.At= 0
R2
L / X
1
10
100
1000


ESQUEMA PROPOSTO - DISPERSAO
TETA= .9
K.At= 0
R2
L / X
1
10
100
1000


ESQUEMA PROPOSTO - DISPERSAO
TETA= 1.
K.At= 0
R2
L / X
1
10
100
1000

APÊNDICE II

O Sistema MDBD é composto de três módulos executáveis, aos quais estão associadas as subrotinas básicas. Todos os módulos do sistema tem a denominação MDBDxxyy, sendo que o índice xx se refere ao número do módulo e yy à versão em uso. Assim, os módulos básicos são:

MODULO	TITULO
MDBD0501	Edição e Entrada de Dados
MDBD1205	Cálculo Hidráulico
MDBD1703	Resultados

Os demais módulos são acionados pelos principais, na forma de subrotinas ou funções, sendo listados a seguir:

MODULO	TITULO	DESCRICAO
MDBD0101	FNPPLV$	Rotina de entrada de teclado
MDBD0201	PAGINA	Formata a tela básica
MDBD0301	DRAWSTRING	Desenha caracteres na Tela
MDBD0401	PINT	Função interpoladora linear
MDBD0601	STELA	Subrotina para gravação de telas gráficas
MDBD0901	HEADER	Cabeçário nas páginas de impressão
MDBD1205	START	Subrotina inicial de cálculo hidráulico
MDBD1302	LEEN	Rotina de cálculo do modelo de LEENDERTSE
MDBD1305	ROI	Rotina de cálculo do modelo implícito
MDBD1401	FNORD	Função de formatação de saídas
MDBD1501	FNMENU	Função de escolha de opções
MDBD1602	PLOT	Plota campo de velocidades

MODULO	TITULO	DESCRICAO
MDBD2301	BOX	Rotina de desenho de caixas na tela
MDBD2401	UTILIDADES	Rotina para instalação do modelo MDBD
MDBD2601	SCANNING	Rotina de busca dos pontos com escoamento
MDBD2701	LEITURA	Rotina de leitura de dados do arquivo
MDBD2801	CONTORNO	Rotina de leitura das condições de contorno

As listagens de todos os módulos estão apresentadas a seguir.

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'######################## FUNCAO PARA AQUISICAO ##############################
'          ############## DE CADEIA ALFANUMERICA. ################
'
'       FINALIDADE
'       PERMITIR A ENTRADA DE UMA CADEIA ALFANUMERICA COM
'       NUMERO DETERMINADO DE ELEMENTOS
'
'       definicao da variavel palmat$ como SHARED
'CRIADA EM:                          POR:FRANCISCO
'ATUALIZADA EM:                      POR:RODOLFO
'MODULO:MDBD0101.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

DEF FNPPLV$(NUMLTS%,VISAO)

   SHARED PALMAT$()
   LOCAL I
   FOR I=1 TO 30
   PALMAT$(I)=""
   NEXT I

   I=0:IY=POS(0):IX=CSRLIN
   LOCATE IX,IY:PRINT STRING$(NUMLTS%,"_");
   LOCATE IX,IY,1,0,7
9  A$=INKEY$:IF A$="" THEN GOTO 9
   IF LEN(A$)<>1 THEN BEEP:GOTO 9
   IF A$=CHR$(27) THEN FNPPLV$=A$:EXIT DEF
   IF A$<>CHR$(13) THEN
   IF (I<NUMLTS%) AND (A$<>CHR$(8)) THEN
          I=I+1
          PALMAT$(I)=A$
          LOCATE IX,IY+I-1
                IF VISAO THEN PRINT A$; ELSE PRINT "X";
   ELSE
          IF A$=CHR$(8) THEN
                PALMAT$(I)=""
                I=I-1
                IF I<0 THEN
                   I=0
                   BEEP
                END IF
                  LOCATE IX,IY+I
                  PRINT" ";
                  LOCATE IX,IY+I
          ELSE
                   BEEP
          END IF
   END IF
   END IF
   IF A$<>CHR$(13) THEN GOTO 9
   A$=""
   FOR I=0 TO NUMLTS%
      A$=A$+PALMAT$(I)
   NEXT I
   LOCATE ,,1
   FNPPLV$=LEFT$(A$,NUMLTS%)
END DEF

'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'          SUBROTINA DE INICIALIZACAO DA PAGINA NA TELA

'CRIADA EM:13/02/1989
'ATUALIZADA EM:04/05/1989                    MODULO: MDBD0201.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

SUB PAGINA(TITULO$)

      SHARED DIA$
      LOCAL I
      CLS
      LOCATE  1,1:PRINT STRING$(80,223);
      LOCATE 25,1:PRINT STRING$(80,220);
      FOR I=1 TO 25
          LOCATE I,1:PRINT CHR$(219);:LOCATE I,80:PRINT CHR$(219);
      NEXT I
      LOCATE 2,3:COLOR 0,7:PRINT TITULO$;
      LOCATE 2,69:PRINT DIA$;
      LOCATE 24,3: PRINT "[ RETURN ] - Avancar";
      LOCATE 24,60:PRINT "[ ESC ] - Retornar";
      COLOR 7,0

END SUB
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

```
'################################################################

'        SUBROTINA PARA DESENHAR FONTES DE CARACTERES

'CRIADA EM 30/06/1988     POR FRANCISCO

'MODULO: MDBD0301.BAS

'Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

SUB DRAWSTRING(X,Y,SIZE,A$)

   SHARED CHAR$()

   FOR I=1 TO LEN(A$)
      ICH=ASC(MID$(A$,I,1))
      IF ICH<32 OR ICH>126 THEN 3200
      FOR IYPOS=0 TO 5
         ICHARSET=VAL(MID$(CHAR$(ICH),( (7-IYPOS)\2-1 )*6+1,6))
         ICHARBYTE=(ICHARSET \ 2^((IYPOS AND 1)*4)) AND &H0F
         FOR IXPOS=0 TO 3
            IF ((ICHARBYTE \ 2^(3-IXPOS)) AND 1) <> 0 THEN
               IXSTART=X+IXPOS*SIZE
               IXEND=IXSTART+SIZE-1
               IYSTART=Y+1+(IYPOS-2)*SIZE
               IYEND=IYSTART+SIZE-1
               FOR YY=IYSTART TO IYEND
                  FOR XX=IXSTART TO IXEND
                     PSET(XX,YY)
                  NEXT XX
               NEXT YY
            END IF
         NEXT
      NEXT
      X=X+SIZE*6
3200   NEXT I

END SUB
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

'    FUNCAO INTERPOLADORA LINEAR

'MDBD0401.BAS            CRIADA POR:RODOLFO
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

DEF FNPINT(N,XX)

    SHARED XX(),YY()

    LOCAL I,YY

    FOR I=2 TO N
      IF XX<=XX(I) THEN 1
    NEXT I
    I=N
1   YY=YY(I-1)+((YY(I)-YY(I-1))/(XX(I)-XX(I-1)))*(XX-XX(I-1))
    FNPINT=YY

END DEF
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'                  MODELO HIDRODINAMICO BIDIMENSIONAL
'                 MODULO DE  ENTRADA DE DADOS DO CAMPO
'                           MDBD0501
'
' CRIADO     EM:04/05/1989                    POR: RODOLFO
' ATUALIZADO EM:                              POR: RODOLFO
' MODULO:MDBD0501.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

'.............................PARAMETROS DO SISTEMA.....................

      CLEAR

      DEFINT I-N
      DEFSNG A-C,E-H,O-Z
      DEFDBL D

      '..........DIMENSIONAMENTO DAS VARIAVEIS
      ID1= 74          'numero maximo de pontos em x
      ID2= 40          'numero maximo de pontos em y

      DIM PALMAT$(40),CHAR$(128),SETA$(4),SIMB$(65:128),CO$(ID1,ID2)

      DIM Z(ID1,ID2),H(ID1,ID2),U(ID1,ID2),V(ID1,ID2),RK(ID1,ID2)


      '...........PARAMETROS AUXILIARES PROVISORIOS

      DRIVE$="C:\MDBD\DADOS\":DRIVEMOD$="C:\MDBD\"
      DRIVESPOOL$="C:\MDBD\SPOOL\"
      MAXLIN=75:ICARACLIN=80:ICARACPOL=8:ITAMPG=80
      DIA$=MID$(DATE$,4,2)+"/"+LEFT$(DATE$,2)+"/"+RIGHT$(DATE$,4)
      NUMLI=0:IPAG=0:ARQ$=""

'.....................INCLUDE SUBROTINAS.................................

$INCLUDE "MDBD0101.BAS"  'FNPPLV$
$INCLUDE "MDBD0201.BAS"  'PAGINA
$INCLUDE "MDBD0301.BAS"  'DRAWSTRING
$INCLUDE "MDBD0601.BAS"  'SAVETELA
$INCLUDE "MDBD0901.BAS"  'HEADER

'.............................................................

'    ---------------CARREGA FONTES-------------

     OPEN "I",#18,DRIVEMOD$+"MDBD4X6.FON"
     WHILE NOT EOF(18)
        LINE INPUT #18,A$
        CHAR$(VAL(MID$(A$,1,4)))=RIGHT$(A$,LEN(A$)-4)
     WEND
     CLOSE #18
'    ------------------------------------------
'
'
'.............................................................
'                 PROGRAMA PRINCIPAL

       ON ERROR GOTO ERRORDEALER
       ON KEY(10) GOSUB KEY10:KEY(10) ON

       LINK$="TELO"
       CALL PAGINA("MODELO BIDIMENSIONAL  -  DADOS DE CAMPO")

TELO:

10     LOCATE 5,3:PRINT "NOME DO ARQUIVO...:";:ARQ$=FNPPLV$(8,-1)
       IF ARQ$=CHR$(27) THEN ESCAPE
       IF UCASE$(ARQ$)="D" THEN DIRETORIO
       IF ARQ$="" AND ARQCAMPO$="" THEN 10
       IF ARQ$<>"" THEN ARQCAMPO$=ARQ$:GOTO 20
       LOCATE 5,22:PRINT ARQCAMPO$
```

```
20      OPEN "R",#1,DRIVE$+ARQCAMPO$+".DCA",19
        IF LOF(1)=0 THEN
            BEEP
            CLOSE #1
            LOCATE  5,40:PRINT "ARQUIVO NOVO!"
            EXIST$="NÃO"
        ELSE
            EXIST$="SIM"

            FIELD #1, 8 AS BARQ$, 2 AS BMAX$, 2 AS BNAX$,
                                    2 AS BNPON$, 4 AS BAX$,1 AS BOB$
            GET #1,1
            MMAX=CVI(BMAX$)
            NMAX=CVI(BNAX$)
            NPON=CVI(BNPON$)
            AX=CVS(BAX$)

            FIELD #1, 19 AS BTITCAMP$
            GET #1,2
            TITCAMPO$=BTITCAMP$
        END IF
        CLOSE #1

30      LOCATE 6,3:PRINT "Nº DE PONTOS EM X.:";:ARQ$=FNPPLV$(5,-1)
        IF ARQ$=CHR$(27) THEN 10
        IF ARQ$="" AND MMAX=0 THEN 30
        IF ARQ$<>"" THEN MMAX=VAL(ARQ$):GOTO 40
        LOCATE 6,22:PRINT USING "#####";MMAX

40      LOCATE 7,3:PRINT "Nº DE PONTOS EM Y.:";:ARQ$=FNPPLV$(5,-1)
        IF ARQ$=CHR$(27) THEN 30
        IF ARQ$="" AND NMAX=0 THEN 40
        IF ARQ$<>"" THEN NMAX=VAL(ARQ$):GOTO 50
        LOCATE 7,22:PRINT USING "#####";NMAX

50      LOCATE 8,3:PRINT "COMPRIMENTO DA MALHA..:";:ARQ$=FNPPLV$(6,-1)
        IF ARQ$=CHR$(27) THEN 40
        IF ARQ$="" AND AX=0 THEN 50
        IF ARQ$<>"" THEN AX=VAL(ARQ$):GOTO 55
        LOCATE 8,27:PRINT USING "#####";AX

55      LOCATE 9,3:PRINT "TITULO DA MALHA.......:";:ARQ$=FNPPLV$(19,-1)
        IF ARQ$=CHR$(27) THEN 50
        IF ARQ$="" AND TITCAMPO$="" THEN 55
        IF ARQ$<>"" THEN TITCAMPO$=ARQ$:GOTO 60
        LOCATE 9,27:PRINT TITCAMPO$

60      DEF SEG=&HB800
        BSAVE "D:TELO",0,4000


'.........................TELA DE EDICAO.............................

TEL1:
        LINK$="TEL1"
        SCREEN 2
        DEF SEG=&HB800
        BLOAD DRIVEMOD$+"TELEDIT.MBD"

        CALL DRAWSTRING(450,195,1,"MDBD-"+DIA$)
        CALL DRAWSTRING(5,4,2,"CAMPO :"+TITCAMPO$)
        CALL DRAWSTRING(410,4,1,"ARQ:"+DRIVE$+ARQCAMPO$)

        CUR$="U2 L2 D3 R4 U3 L2 D2 L2 R4 L2"
        SIMB$(ASC("A"))="C0 "+CUR$+" C7"
        SIMB$(ASC("H"))="N U1 N D1 L2 R4"
        SIMB$(ASC("T"))="L1 D1 R2 U1 L1"
        SIMB$(ASC("I"))="U1 D1 "
        SIMB$(ASC("U"))="L2 R4 L2"
        SIMB$(ASC("V"))="U2 D3 U1"
        seta$(1)=chr$(24)
        seta$(2)=chr$(25)
        seta$(3)=chr$(27)
        seta$(4)=chr$(26)


        IF EXIST$="SIM" THEN LEITURA
```

```
        I=28:J=24:I0=0:J0=0:FLG=3
        PSET (I,J):DRAW CUR$
EDIT:
        LOCATE 1,72:PRINT FLG$+SETA$(FLG)+"/"+(LEFT$(TIME$,5))
        M=(I-20)/8:N=(J-20)/4
        LOCATE 24,4:PRINT USING "###";M ;
        LOCATE 24,10:PRINT USING "###";N;
        LOCATE 24,73:PRINT CO$(M,N);
        IF LEFT$(CO$(M,N),1)="" THEN ACUR$=SIMB$(ASC("A")) ELSE _
                ACUR$=SIMB$(ASC("A"))+SIMB$(ASC(LEFT$(CO$(M,N),1)))

        WHILE NOT INSTAT:WEND

        C$=UCASE$(INKEY$)

        IF C$=CHR$(27) THEN
            I0=I:J0=J
            DRAW ACUR$:PSET (I,J),1
            GOTO ESCAPE
        END IF

        IF LEN(C$)=2 AND RIGHT$(C$,1)="H" THEN
FLG1:
           FLG=1
           DRAW ACUR$:PSET (I,J),1
           J=J-4:IF J<24 THEN J=180
           PSET (I,J):DRAW CUR$
           GOTO EDIT
         END IF

         IF LEN(C$)=2 AND RIGHT$(C$,1)="P" THEN
FLG2:
           FLG=2
           DRAW ACUR$:PSET (I,J),1
           J=J+4:IF J>180 THEN J=24
           PSET (I,J):DRAW CUR$
           GOTO EDIT
         END IF

         IF LEN(C$)=2 AND RIGHT$(C$,1)="K" THEN
FLG3:
           FLG=3
           DRAW ACUR$:PSET (I,J),1
           I=I-8:IF I<28 THEN I=612
           PSET (I,J):DRAW CUR$
           GOTO EDIT
         END IF

         IF LEN(C$)=2 AND RIGHT$(C$,1)="M" THEN
FLG4:
           FLG=4
           DRAW ACUR$:PSET (I,J),1
           I=I+8:IF I>612 THEN I=28
           PSET (I,J):DRAW CUR$
           GOTO EDIT
         END IF

         IF LEN(C$)=2 AND RIGHT$(C$,1)="G" THEN
           DRAW ACUR$:PSET (I,J),1
           I=28:J=24
           PSET (I,J):DRAW CUR$
           GOTO EDIT
         END IF

         IF LEN(C$)=2 AND RIGHT$(C$,1)="O" THEN
           DRAW ACUR$:PSET (I,J),1
           I=612:J=180
           PSET (I,J):DRAW CUR$
           GOTO EDIT
         END IF

         LINK$="EDIT"
         IF C$="Z" OR C$="N" OR C$="X" OR C$="Y" OR C$="K"  THEN FLG$=C$

         IF C$="H" OR C$= CHR$(32) OR C$="T" OR C$="I" OR C$="U" OR C$="V" THEN
             IF C$=CHR$(32) THEN C$="A"
```

```
            CO$(M,N)=C$
            LOCATE 24,73:PRINT CO$(M,N);
            IF LEFT$(CO$(M,N),1)="" THEN ACUR$=SIMB$(65) ELSE _
                ACUR$=SIMB$(65)+SIMB$(ASC(LEFT$(CO$(M,N),1)))
            ON FLG GOTO FLG1,FLG2,FLG3,FLG4
        END IF

        IF C$=CHR$(13) THEN ENTRY

        IF C$="P" THEN CALL SAVETELA
        IF C$="L" THEN LISTA
        IF C$="D" THEN SHELL
        IF C$=CHR$(1) THEN OVERALL

        GOTO EDIT

'.....................LINHA DE ENTRADA DOS DADOS DO PONTO ..............
ENTRY:
        IF FLG$="Z" THEN 70
        IF FLG$="N" THEN 80
        IF FLG$="X" THEN 90
        IF FLG$="Y" THEN 100
        IF FLG$="K" THEN 110


70      LOCATE 24,75:PRINT USING "###.#";Z(M,N);:LOCATE 24,19:Z$=FNPPLV$(5,-1)
        IF Z$=CHR$(27) THEN 140
        IF Z$="" AND Z(M,N)=0 AND Z0$="" THEN 70
        IF Z$<>"" THEN Z(M,N)=VAL(Z$):Z0$=Z$:GOTO 140
        IF Z$="" AND Z(M,N)=0 AND Z0$<>"" THEN Z(M,N)=VAL(Z0$)
        LOCATE 24,19:PRINT USING "###.#";Z(M,N);
        GOTO 140

80      LOCATE 24,75:PRINT USING "###.#"; H(M,N);:LOCATE 24,30:H$=FNPPLV$(5,-1)
        IF H$=CHR$(27) THEN  140
        IF H$="" AND H(M,N)=0 AND H0$="" THEN 80
        IF H$<>"" THEN H(M,N)=VAL(H$):H0$=H$:GOTO 140
        IF H$="" AND H(M,N)=0 AND H0$<>"" THEN H(M,N)=VAL(H0$)
        LOCATE 24,30:PRINT USING "###.#";H(M,N);
        GOTO 140

90      LOCATE 24,75:PRINT USING "##.##"; U(M,N);:LOCATE 24,43:U$=FNPPLV$(5,-1)
        IF U$=CHR$(27) THEN 140
        IF U$="" AND U(M,N)=0 AND U0$="" THEN 90
        IF U$<>"" THEN U(M,N)=VAL(U$):U0$=U$:GOTO 140
        IF U$="" AND U(M,N)=0 AND U0$<>"" THEN U(M,N)=VAL(U0$)
        LOCATE 24,43:PRINT USING "##.##";U(M,N);
        GOTO 140

100     LOCATE 24,75:PRINT USING "##.##"; V(M,N);:LOCATE 24,56:V$=FNPPLV$(5,-1)
        IF V$=CHR$(27) THEN 140
        IF V$="" AND V(M,N)=0 AND V0$="" THEN 100
        IF V$<>"" THEN V(M,N)=VAL(V$):V0$=V$:GOTO 140
        IF V$="" AND V(M,N)=0 AND V0$<>"" THEN V(M,N)=VAL(V0$)
        LOCATE 24,56:PRINT USING "##.##";V(M,N);
        GOTO 140

110     LOCATE 24,75:PRINT USING "#.##"; RK(M,N);:LOCATE 24,64:K$=FNPPLV$(4,-1)
        IF K$=CHR$(27) THEN 140
        IF K$="" AND RK(M,N)=0 AND K0$="" THEN 110
        IF K$<>"" THEN RK(M,N)=VAL(K$):K0$=K$:GOTO 140
        IF K$="" AND RK(M,N)=0 AND K0$<>"" THEN RK(M,N)=VAL(K0$)
        LOCATE 24,64:PRINT USING "#.##";RK(M,N);


140     LOCATE 24,19:PRINT "     ";:LOCATE 24,30:PRINT "     ";:
        LOCATE 24,43:PRINT "     ";:LOCATE 24,56:PRINT "     ";:
        LOCATE 24,64:PRINT "    "; :LOCATE 24,75:PRINT "     ";:

        ON FLG GOTO FLG1,FLG2,FLG3,FLG4
        GOTO EDIT

'.....................................................................
OVERALL:

        LOCATE 24,75:Z$=FNPPLV$(5,-1)
        IF Z$=CHR$(27) THEN 140
```

```
        LOCATE 24,75:PRINT "WAIT";

        IF FLG$="Z" THEN
              ZALL=VAL(Z$)
              FOR M=1 TO ID1
              FOR N=1 TO ID2
              IF CO$(M,N)<>"" AND CO$(M,N)<>CHR$(32) THEN Z(M,N)=ZALL
              NEXT N
              NEXT M
              GOTO 140
        END IF
        IF FLG$="N" THEN
              HALL=VAL(Z$)
              FOR M=1 TO ID1
              FOR N=1 TO ID2
              IF CO$(M,N)<>"" AND CO$(M,N)<>CHR$(32) THEN H(M,N)=HALL
              NEXT N
              NEXT M
              GOTO 140
        END IF
        IF FLG$="X" THEN
              UALL=VAL(Z$)
              FOR M=1 TO ID1
              FOR N=1 TO ID2
              IF CO$(M,N)<>"" AND CO$(M,N)<>CHR$(32) THEN U(M,N)=UALL
              NEXT N
              NEXT M
              GOTO 140
        END IF
        IF FLG$="Y" THEN
              VALL=VAL(Z$)
              FOR M=1 TO ID1
              FOR N=1 TO ID2
              IF CO$(M,N)<>"" AND CO$(M,N)<>CHR$(32) THEN V(M,N)=VALL
              NEXT N
              NEXT M
              GOTO 140
        END IF
        IF FLG$="K" THEN
              RKALL=VAL(Z$)
              FOR M=1 TO ID1
              FOR N=1 TO ID2
              IF CO$(M,N)<>"" AND CO$(M,N)<>CHR$(32) THEN RK(M,N)=RKALL
              NEXT N
              NEXT M
              GOTO 140
        END IF
        GOTO EDIT

'.....................................................................
LEITURA:

        OPEN "R",#1,DRIVE$+ARQCAMPO$+".DCA",19

        FIELD #1, 8 AS BARQ$, 2 AS BMAX$, 2 AS BNAX$,2 AS BNPON$, 5 AS BOB$
        GET #1,1
        MMAX=CVI(BMAX$)
        NMAX=CVI(BNAX$)
        NPON=CVI(BNPON$)
        FIELD #1,2 AS BM$,2 AS BN$,1 AS BC$,4 AS BZ$,4 AS BH$, _
              2 AS BU$,2 AS BV$,2 AS BK$

        FOR IR=11 TO NPON+10

           GET #1,IR
           M=CVI(BM$):N=CVI(BN$)
           CO$(M,N)=BC$
           Z(M,N)=CVS(BZ$):H(M,N)=CVS(BH$):
           U(M,N)=CSNG(CVI(BU$))/100:V(M,N)=CSNG(CVI(BV$))/100
           RK(M,N)=CSNG(CVI(BK$))/1000
           I=M*8+20:J=N*4+20
           PSET (I,J):DRAW SIMB$(ASC(CO$(M,N)))

        NEXT IR
           PSET (I,J):DRAW  CUR$
        CLOSE #1
        GOTO EDIT
```

```
'.....................................................................
SALVA:
        KEY(10) OFF
        DEF SEG=&HB800
        BSAVE "D:TEL1",0,16384
        SCREEN 0
        BLOAD "D:TEL0"
        LINK$="SALVA"

149     IF EXIST$="SIM" THEN
            LOCATE 12,3:PRINT "ARQUIVO JA EXIXTE!      OK PARA SOBREPOR?  N"
            LOCATE 12,46:PER$=UCASE$(FNPPLV$(1,-1))

            IF PER$<>"S"  THEN
150            LOCATE 5,3:PRINT "NOME DO ARQUIVO...:";:ARQ$=FNPPLV$(8,-1)
               IF ARQ$=CHR$(27) THEN ESCAPE
               IF ARQ$="" AND ARQCAMPO$="" THEN 150
               IF ARQ$<>"" THEN ARQCAMPO$=ARQ$
               LOCATE 5,22:PRINT ARQCAMPO$
               OPEN "R",#1,DRIVE$+ARQCAMPO$+".DCA",19
               IF LOF(1)=0 THEN EXIST$="NAO" ELSE EXIST$="SIM"
               CLOSE #1
               GOTO 149
            END IF
        END IF

        LOCATE 12,3:PRINT SPC(68)
        LOCATE 15,3:COLOR 23,0:PRINT "SALVANDO...:"+DRIVE$+ARQCAMPO$

        SHELL "COPY "+DRIVE$+ARQCAMPO$+".DCA "+DRIVE$+"MDBD.BBK >d:dummy"
        SHELL "DEL "+DRIVE$+ARQCAMPO$+".DCA >d:dummy"

        OPEN "R",#1,DRIVE$+ARQCAMPO$+".DCA",19
        EXIST$="SIM"


          FIELD #1,2 AS BM$,2 AS BN$,1 AS BC$,4 AS BZ$,4 AS BH$, _
                2 AS BU$,2 AS BV$,2 AS BK$

          MMAX=0:NMAX=0:IR=10:MMIN=ID1:NMIN=ID2

          FOR M=1 TO ID1
             FOR N=1 TO ID2
               IF CO$(M,N)="T" OR CO$(M,N)="H" OR CO$(M,N)="I"
                        OR CO$(M,N)="U" OR CO$(M,N)="V" THEN GOSUB PUTREG
             NEXT N
          NEXT M

          FIELD #1, 8 AS BARQ$, 2 AS BMAX$, 2 AS BNAX$,
                                  2 AS BNPON$, 4 AS BAX$, 1 AS BOB$
          LSET BARQ$=ARQCAMPO$
          LSET BMAX$=MKI$(MMAX)
          LSET BNAX$=MKI$(NMAX)
          LSET BNPON$=MKI$(IR-10)
          LSET BAX$=MKS$(AX)
          LSET BOB$=" "
          PUT #1,1

          FIELD #1, 19 AS BTITCAMP$
          LSET BTITCAMP$=TITCAMPO$
          PUT #1,2

        CLOSE #1

        LOCATE 15,3:COLOR 7,0:PRINT "OK! ARQUIVO:"+DRIVE$+ARQCAMPO$
        DELAY 1
        SCREEN 2
        BLOAD "D:TEL1"
        LINK$="TEL1"
        I=I0:J=J0: PSET (I,J):DRAW CUR$
        CALL DRAWSTRING(410,4,1,"ARQ:"+DRIVE$+ARQCAMPO$)
        ON KEY(10) GOSUB KEY10:KEY(10) ON
        RETURN EDIT

PUTREG:
```

```
            LSET BM$=MKI$(M):LSET BN$=MKI$(N)
            LSET BC$=CO$(M,N)
            LSET BZ$=MKS$(Z(M,N)):LSET BH$=MKS$(H(M,N))
            LSET BU$=MKI$(INT(U(M,N)*100)):LSET BV$=MKI$(INT(V(M,N)*100))
            LSET BK$=MKI$(INT(RK(M,N)*1000))

            INCR IR:PUT #1,IR
            IF M>MMAX THEN MMAX=M
            IF N>NMAX THEN NMAX=N

        RETURN

'.....................................................................
LISTA:

        CABEC$=" DADOS DO ARQUIVO:"+TITCAMPO$

        IF FLG$="Z" THEN
        FRASE$="BATIMETRIA DO ARQUIVO: "+ARQCAMPO$+"  -  Cotas em m"
        IF FLG$="K" THEN
        FRASE$="RUGOSIDADES DO ARQUIVO: "+ARQCAMPO$+"  -  K em mm"

        IF FLG$="N" THEN
        FRASE$="NIVEL D'AGUA - ARQUIVO: "+ARQCAMPO$+"  -  Cotas em mm"
        IF FLG$="X" THEN
        FRASE$="VELOCIDADES EM X - ARQUIVO: "+ARQCAMPO$+"  -  (m/s)"
        IF FLG$="Y" THEN
        FRASE$="VELOCIDADES EM Y - ARQUIVO: "+ARQCAMPO$+"  -  (m/s)"


        CALL HEADER(-1,CABEC$,ITAMPG)

        FOR NP=1 TO NMAX STEP 26

          CALL HEADER(0,CABEC$,ITAMPG)
          PRINT #20,""
          PRINT #20,TAB((ITAMPG-LEN(FRASE$))/2) FRASE$
          PRINT #20,""
          PRINT #20,CHR$(15)

          LIPRINT=NP+26-1:IF LIPRINT>NMAX THEN LIPRINT=NMAX
          PRINT #20,"¦YX¦";
          FOR JP=NP TO LIPRINT
              PRINT #20,USING "#####";JP;
          NEXT JP
          PRINT #20,"¦YX"
          PRINT #20,STRING$(137,45)
          FOR MP=MMAX TO 1 STEP -1
             PRINT #20,USING "¦##¦";MP;
             FOR JP=NP TO LIPRINT
                IF FLG$="Z" THEN PRINT #20,USING "###.#";Z(MP,JP);
                IF FLG$="N" THEN PRINT #20,USING "###.#";H(MP,JP);
                IF FLG$="K" THEN PRINT #20,USING "#.###";RK(MP,JP);
                IF FLG$="X" THEN PRINT #20,USING "###.#";U(MP,JP);
                IF FLG$="Y" THEN PRINT #20,USING "###.#";V(MP,JP);
             NEXT JP
             PRINT #20,USING "¦##";MP
          NEXT MP
          PRINT #20,CHR$(18)
        NEXT NP
        CALL HEADER(-2,"",ITAMPG)
        GOTO EDIT

'.....................................................................
SHELL:
        DEF SEG=&HB800
        BSAVE "D:TEL1:",0,16384
        SCREEN 0
        CLS
        SHELL
        SCREEN 2
        BLOAD "D:TEL1"
        GOTO EDIT
'.....................................................................
DIRETORIO:
        DEF SEG=&HB800
```

```
        BSAVE "D:TEL0",0,4000
        LOCATE 7,3:PRINT STRING$(74,"■")
        LOCATE 8,1:FILES DRIVE$
        WHILE NOT INSTAT:WEND:BOB$=INKEY$
        BLOAD "D:TEL0"
        GOTO 10
'.....................................................................

ESCAPE:
     IF LINK$="TEL0" THEN STOP
     IF LINK$="TEL1" THEN
          CLOSE
          SCREEN 0
          LINK$="TEL0"
          BLOAD "D:TEL0"
          GOTO TEL0
     END IF
     IF LINK$="EDIT" THEN GOSUB SALVA
     IF LINK$="SALVA" THEN
       LOCATE 15,3:COLOR 7,0:PRINT "NAO GRAVADO:"+DRIVE$+ARQCAMPO$
       DELAY .5
       SCREEN 2
       BLOAD "D:TEL1"
       LINK$="TEL1"
       ON KEY(10) GOSUB KEY10:KEY(10) ON
       I=I0:J=J0:PSET (I,J):DRAW CUR$
       GOTO EDIT
     END IF

'.....................................................................
ERRORDEALER:
      BEEP
      PRINT "ERROR:"ERR"  NO ENDERECO:"ERADR
      STOP
'.....................................................................
KEY10:
      STOP
'.....................................................................
```

```
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
'
'                       SUBROTINA  STELA
'
'
' Finalidade: SALVAR A TELA GRAFICA PARA IMPRESSAO
'
' Criado em:      05/02/1988              por: Rodolfo
' Atualizado em:  20/08/1988              modulo: MDBD0601.BAS
'
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
'
   SUB SAVETELA

   SHARED DRIVE$,DRIVEMOD$,DRIVESPOOL$,OPERNIV$,ARQTEL$
'
'           IF CVI(OPERNIV$)<=3 THEN BEEP:EXIT SUB
          OPEN "R",#19,DRIVESPOOL$+"CONTTEL",2
             FIELD #19, 2 AS CONT$
             GET #19,1:ICONT=CVI(CONT$)+1:LSET CONT$=MKI$(ICONT):PUT #19,1
          CLOSE #19
          ARQTEL$=STR$(ICONT)
          ARQTEL$=LEFT$("00",4-LEN(ARQTEL$))+RIGHT$(ARQTEL$,LEN(ARQTEL$)-1)
          ARQTEL$=DRIVESPOOL$+"TELMDBD."+ARQTEL$
          BSAVE ARQTEL$,0,16384

   END SUB
'
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

```
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
'
'                       SUBROTINA  HEADER
'
'
' Finalidade: Imprimir o Header nas paginas da listagem
'             Controle de arquivo para impressao com PRINT
'
' Criado em:      05/02/1988                por: Rodolfo
' Atualizado em:  21/08/1989                modulo: MDBD0901.BAS
'
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
'
   SUB HEADER(LIN,TITULO$,ITAMP)
'
   SHARED NUMLI, IPAG, DIA$,DRIVEMOD$,DRIVESPOOL$,ARQ$,MAXLIN
   LOCAL ICONT
'
'
   IF LIN > 0 THEN
       IF NUMLI + LIN < MAXLIN THEN
          NUMLI=NUMLI+LIN
          EXIT SUB
       ELSE
          IPAG=IPAG+1
          NUMLI=6+LIN
          PRINT #20,CHR$(12)
       END IF
   ELSE
       IF LIN=-1 THEN
          OPEN "R",#19,"D:CONTPRIN",2
             FIELD #19, 2 AS CONT$
             GET #19,1:ICONT=CVI(CONT$)+1:LSET CONT$=MKI$(ICONT):PUT #19,1
          CLOSE #19
          ARQ$=STR$(ICONT)
          ARQ$=LEFT$("00",4-LEN(ARQ$))+RIGHT$(ARQ$,LEN(ARQ$)-1)
          ARQ$=DRIVESPOOL$+"PRBD."+ARQ$

'-----------------------------------------------------------------
          OPEN "R",#19,DRIVEMOD$+"MDBD.CNF",55
           FIELD #19,2 AS PARM1$,2 AS PARM2$,2 AS PARM3$,49 AS PARM4$

'-------------------PARAMETROS DA IMPRESSAO ----------------------

           GET #19,2
           MPARM1$=PARM1$:MPARM2$=PARM2$:MPARM3$=PARM3$:MPARM4$=PARM4$:
           ITAMP=CVI(MPARM1$):ICARACLIN=CVI(MPARM2$)
           ICARACPOL=CVI(MPARM3$)
           IF ITAMP=0 THEN ITAMP=80
           IF ICARACPOL<>8 THEN ICARACPOL=6:MAXLIN=57
           IF ICARACPOL=8 THEN MAXLIN=71
           IF ICARACLIN=0 THEN ICARACLIN=80
          CLOSE #19
'-----------------------------------------------------------------

          OPEN "O",#20,ARQ$
           IPAG=0:NUMLI=6
           PRINT #20,CHR$(27)"@"
           PRINT #20,CHR$(27)RIGHT$(STR$(ABS(8-ICARACPOL)),1)
           WIDTH "LPT1:",ICARACLIN
       END IF

       IF LIN=-2 THEN
          CLOSE #20
          SHELL "D:PRINT "+ARQ$+"/P>D:DUMMY"
          EXIT SUB
       END IF
       IF LIN=0 AND NUMLI>6 THEN
          IPAG=IPAG+1:NUMLI=6
          PRINT #20,CHR$(12)
       END IF
       IF LIN=0 AND NUMLI<=6 THEN EXIT SUB
   END IF

   PRINT #20, "+";STRING$(ITAMP-3,"=");"+"

   PRINT #20, "¦";
```

```
    PRINT #20, TAB((ITAMP-70)/2) "$$$      F C T H  FUNDACAO CENTRO TECNOLOGICO DE HIDRAULICA      $$$";
    PRINT #20, TAB(ITAMP-1) "¦"

    PRINT #20, "¦";
    PRINT #20, TAB(( ITAMP-LEN(TITULO$)-1)/2);TITULO$;
    PRINT #20, TAB(ITAMP-1) "¦"

    PRINT #20, "¦   ";DIA$;
    PRINT #20, TAB(ITAMP-15) "PAGINA:"; IPAG;
    PRINT #20, TAB(ITAMP-1)"¦"

    PRINT #20, "+";STRING$(ITAMP-3,"=");"+"

    PRINT #20,""

    END SUB

'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'                 MODELO HIDRODINAMICO BIDIMENSIONAL
'                 MODULO DE  SIMULACAO DO ESCOAMENTO  - START
'                          MDBD1205
'
' CRIADO     EM:22/08/1989                    POR: RODOLFO
' ATUALIZADO EM:15/09/1989                    POR: RODOLFO
' MODULO:MDBD1205.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

'.............................PARAMETROS DO SISTEMA.....................

      CLEAR


      DEFINT I-N
      DEFSNG A-H,O-Z

      '..........DIMENSIONAMENTO DAS VARIAVEIS
      ID1= 74          'numero maximo de pontos em x
      ID2= 40          'numero maximo de pontos em y
      ID3= 24          'numero maximo de intervalos de tempo de dados
      ID4= 10          'numero maximo de arquivos de condicoes de contorno

      DIM PALMAT$(40),CO$(ID1,ID2),MSEC$(2*ID2),NSEC$(2*ID1),CON$(ID4)
      DIM LOCON$(ID4),CHAR$(128)

      DIM Z(ID1,ID2),H(ID1,ID2),U(ID1,ID2),V(ID1,ID2),RK(ID1,ID2),C(ID1,ID2)
      DIM HP(ID1,ID2),UP(ID1,ID2),VP(ID1,ID2)
      DIM AH(ID1,ID2),AU(ID1,ID2),AV(ID1,ID2)
      DIM R(ID1),S(ID1),P(ID1),Q(ID1)
      DIM XB(ID4,ID3),CB(ID4,ID3),XX(ID3),YY(ID3)

      DIM NPCON(ID4)

      '...........PARAMETROS AUXILIARES PROVISORIOS

      DRIVE$="C:\mdbd\dados\":DRIVEMOD$="C:\mdbd\":DRIVESPOOL$="C:\MDBD\SPOOL\"
      MAXLIN=75:ICARACLIN=80:ICARACPOL=8:ITAMPG=80
      DIA$=MID$(DATE$,4,2)+"/"+LEFT$(DATE$,2)+"/"+RIGHT$(DATE$,4)
      NUMLI=0:IPAG=0:ARQ$=""

      OPEN "I",#1,DRIVEMOD$+"COMMON.MBD"
      INPUT #1,ARQCAMPO$
      INPUT #1,NARCON
      FOR I=1 TO NARCON
        INPUT #1,CON$(I),LOCON$(I)
      NEXT I
      CLOSE #1


'...................INCLUDE SUBROTINAS.................................

$INCLUDE "MDBD0101.BAS"  'FNPPLV$
$INCLUDE "MDBD0201.BAS"  'PAGINA
$INCLUDE "MDBD0301.BAS"  'DRAWSTRING
$INCLUDE "MDBD0401.BAS"  'Pint
$INCLUDE "MDBD0601.BAS"  'SAVETELA
$INCLUDE "MDBD0901.BAS"  'HEADER
$INCLUDE "MDBD1601.BAS"  'PLOT
'
'    ---------------CARREGA FONTES-------------

     OPEN "I",#18,"MDBD4X6.FON"
     WHILE NOT EOF(18)
        LINE INPUT #18,A$
        CHAR$(VAL(MID$(A$,1,4)))=RIGHT$(A$,LEN(A$)-4)
     WEND
     CLOSE #18
'*************************************************************'
'
'
'
'.............................................................
'               PROGRAMA PRINCIPAL
START:
```

```
      ON ERROR GOTO ERRORDEALER
      ON KEY(10) GOSUB KEY10:KEY(10) ON

      LINK$="TELO"
      CALL PAGINA("MODELO BIDIMENSIONAL-RO  -  SIMULACAO DO ESCOAMENTO")

'.....................ENTRADA DE DADOS GERAIS ..................
TELO:

10   LOCATE 5,3:PRINT "NOME DO ARQUIVO   :";:ARQ$=FNPPLV$(8,-1)
      IF ARQ$=CHR$(27) THEN ESCAPE
      IF ARQ$="" AND ARQCAMPO$="" THEN 10
      IF ARQ$<>"" THEN ARQCAMPO$=ARQ$:GOTO 20
      LOCATE 5,22:PRINT ARQCAMPO$

20    OPEN "R",#1,DRIVE$+ARQCAMPO$+".DCA",19
      IF LOF(1)=0 THEN
          BEEP
          CLOSE #1
          LOCATE  5,40:PRINT "ARQUIVO DE CAMPO NAO EXISTE!"
          DELAY 1
          GOTO ESCAPE
      ELSE
          FIELD #1, 8 AS BARQ$, 2 AS BMAX$, 2 AS BNAX$,
                                  2 AS BNPON$, 4 AS BAX$,1 AS BOB$
          GET #1,1
          MMAX=CVI(BMAX$)
          NMAX=CVI(BNAX$)
          NPON=CVI(BNPON$)
          AX=CVS(BAX$)

          FIELD #1, 19 AS BTITCAMP$
          GET #1,2
          TITCAMPO$=BTITCAMP$
      END IF
      CLOSE #1

30    LOCATE 6,3:PRINT  USING "No DE PONTOS EM X     :#####";MMAX

40    LOCATE 7,3:PRINT  USING "No DE PONTOS EM Y     :#####";NMAX

50    LOCATE 8,3:PRINT  USING "COMPRIMENTO DA MALHA  :#####";AX

60    LOCATE 9,3:PRINT  USING "TITULO DA MALHA       :&";LEFT$(TITCAMPO$,13);

      GRAV=9.81
70    LOCATE 10,3:PRINT       "ACEL. GRAVIDADE       :";:G$=FNPPLV$(4,-1)
      IF G$=CHR$(27) THEN 10
      IF G$<>"" THEN GRAV=VAL(G$)
      LOCATE 10,26:PRINT USING "##.##";GRAV

      ATD=3600
80    LOCATE 11,3:PRINT       "TEMPO DOS DADOS       :";:G$=FNPPLV$(5,-1)
      IF G$=CHR$(27) THEN 70
      IF G$<>"" THEN ATD=VAL(G$)
      LOCATE 11,26:PRINT USING "#####";ATD

      ATC=180
90    LOCATE 12,3:PRINT       "TEMPO DOS CALCULOS    :";:G$=FNPPLV$(5,-1)
      IF G$=CHR$(27) THEN 80
      IF G$<>"" THEN ATC=VAL(G$)
      LOCATE 12,26:PRINT USING "#####";ATC

95    IOPS=10
      LOCATE 13,3:PRINT       "INTERVALO DE SAIDA    :";:G$=FNPPLV$(4,-1)
      IF G$=CHR$(27) THEN 90
      IF G$<>"" THEN IOPS=VAL(G$)
      LOCATE 13,26:PRINT USING "#####";IOPS

102   TETA=1.
      LOCATE 14,3:PRINT       "COEFICIENTE TETA      :";:G$=FNPPLV$(4,-1)
      IF G$=CHR$(27) THEN 95
      IF G$<>"" THEN TETA=VAL(G$)
      LOCATE 14,26:PRINT USING "#####";TETA


104   NITERA=2
```

```
      LOCATE 15,3:PRINT       "NUMERO DE ITERACOES   :";:G$=FNPPLV$(4,-1)
      IF G$=CHR$(27) THEN 102
      IF G$<>"" THEN NITERA=VAL(G$)
      LOCATE 15,26:PRINT USING "#####";NITERA

      TITSIMUL$="SIMULACAO ARQUIVO "+ARQCAMPO$+" "+TITCAMPO$
100   LOCATE 16,3:PRINT       "TITULO DA SIMULACAO";
      LOCATE 17,3:G$=FNPPLV$(30,-1)
      IF G$=CHR$(27) THEN 104
      IF G$<>"" THEN TITSIMUL$=G$
      LOCATE 17,03:PRINT LEFT$(TITSIMUL$,35)

      FOR I=5 TO 22 :LOCATE I,40:PRINT "|":NEXT I


110   LOCATE 5,45:PRINT "ARQUIVOS DE CONDICOES DE CONTORNO"
      COLOR 0,5:LOCATE 7,41:PRINT     " N°   Nome          Li/Col In/Fi      ";
      COLOR 7,0
      FOR I=1 TO 10
120     LOCATE I+7,42,1,0,7:PRINT I
        WHILE NOT INSTAT:WEND:CON$=INKEY$
        IF CON$=CHR$(27) THEN 100
        IF CON$=CHR$(29) THEN 135
        IF CON$=CHR$(13) AND I>2 THEN 140
125     LOCATE I+7,46:CON$=FNPPLV$(8,-1)
          IF CON$=CHR$(27) THEN 120
          IF CON$="" AND CON$(I)="" THEN 125
          IF CON$<>"" THEN CON$(I)=CON$
          LOCATE I+7,46:PRINT CON$(I);

130     LOCATE I+7,59:CON$=FNPPLV$(18,-1)
          IF CON$=CHR$(27) THEN 125
          IF CON$="" AND LOCON$(I)="" THEN 130
          IF CON$<>"" THEN LOCON$(I)=CON$
          LOCATE I+7,59:PRINT LOCON$(I);
135     NEXT I
140     NARCON=I-1

'.................CONTROLE DE LEITURA DOS DADOS.....................


      DEF SEG=&HB800
      BSAVE "D:TELO",0,4000

      LINK$="TEL1"
      LOCATE 18,3:PRINT STRING$(76,205)
      LOCATE 19,3:COLOR 23,0
      PRINT "LEITURA DOS DADOS DE CAMPO":COLOR 7,0
      GOSUB LEITURA
      LOCATE 19,3:PRINT "LEITURA DOS DADOS DE CAMPO"
      LOCATE 20,3:COLOR 23,0
      PRINT "SCANNING":COLOR 7,0
      GOSUB SCANNING
      LOCATE 20,3:PRINT "SCANNING"
      LOCATE 21,3:COLOR 23,0
      PRINT "LEITURA DO CONTORNO":COLOR 7,0
      GOSUB CONTORNO
      LOCATE 21,3:PRINT "LEITURA DO CONTORNO"

'                ##############################################
                  $INCLUDE "MDBD1305.BAS"   'CALCULO IMPLICITO
'                 ##############################################


'                 ##############################################
'                  $INCLUDE "MDBD1302.BAS"   'CALCULO LEENDERTSE
'                 ##############################################


STOP

'.....................................................................

$INCLUDE "MDBD2701.BAS"    'LEITURA
$INCLUDE "MDBD2601.BAS"    'SCANNING
$INCLUDE "MDBD2801.BAS"    'CONTORNO
```

```
'.....................................................................
KEY3:
'           PLOTA VALORES DO CAMPO DE VELOCIDADES
      KEY(5) OFF:KEY(7) OFF:KEY(9) OFF
      DEF SEG=&HB800
      BSAVE "D:TEL1",0,4000
      LOCATE 23,43:PRINT "ESCALA U:";:ESCU=VAL(FNPPLV$(4,-1))
      LOCATE 23,60:PRINT "ESCALA V:";:ESCV=VAL(FNPPLV$(4,-1))
      IF ESCU<=0 OR ESCV<=0 THEN KEY3
      CALL PLOT(ESCU,ESCV,1,1)
      WHILE NOT INSTAT:WEND:BOB$=INKEY$
      IF UCASE$(BOB$)="P" THEN CALL SAVETELA:GOTO KEY3
      SCREEN 0
      BLOAD "D:TEL1"
      ON KEY(3) GOSUB KEY3:KEY(3) ON
      LOCATE 23,43:PRINT SPC(35);
      ON KEY(3) GOSUB KEY3:KEY(3) ON
      ON KEY(5) GOSUB KEY5:KEY(5) ON
      ON KEY(7) GOSUB KEY7:KEY(7) ON
      ON KEY(9) GOSUB KEY9:KEY(9) ON
      RETURN

'.....................................................................
'           MOSTRA VALORES DO INSTANTE DE CALCULO
KEY5:
      KEY(3) OFF:KEY(7) OFF:KEY(9) OFF
      IF FLG$="" THEN
          LOCATE 23,43:PRINT "VERIFICANDO.....:";:FLG$=UCASE$(INKEY$)
          IF FLG$<>"Z" AND FLG$<>"U" AND FLG$<>"V" AND  FLG$<>"K" AND_
                          FLG$<>"K"  THEN KEY5
      END IF

      DEF SEG=&HB800
      BSAVE "D:TEL1",0,4000
      CLS
      IF MPRI=0 THEN MPRI=MMIN:NPRI=NMIN

MOSTRA1:
      IF FLG$="Z" THEN IOP=1
      IF FLG$="K" THEN IOP=2
      IF FLG$="N" THEN IOP=3
      IF FLG$="U" THEN IOP=4
      IF FLG$="V" THEN IOP=5

      ON IOP GOTO Z,K,N,U,V
Z:
      FRASE$="BATIMETRIA DO ARQUIVO: "+ARQCAMPO$+"  -  Cotas em m":GOTO MOSTRA
K:
      FRASE$="RUGOSIDADES DO ARQUIVO: "+ARQCAMPO$+"  -  K em mm":GOTO MOSTRA
N:
      FRASE$="NIVEL D'AGUA - ARQUIVO: "+ARQCAMPO$+"  -  Cotas em mm":GOTO MOSTRA
U:
      FRASE$="VELOCIDADES EM X - ARQUIVO: "+ARQCAMPO$+"  -  (m/s)":GOTO MOSTRA
V:
      FRASE$="VELOCIDADES EM Y - ARQUIVO: "+ARQCAMPO$+"  -  (m/s)":GOTO MOSTRA


MOSTRA:
      LOCATE 1,(80-LEN(FRASE$))/2:PRINT FRASE$
      COLOR 0,5:LOCATE 2,1,1
      PRINT "¦YX¦";
      FOR MP=MPRI TO MPRI+14
          PRINT USING "#####";MP;
      NEXT MP
      LI=2
      FOR NP=NPRI TO NPRI+21
        INCR LI
        LOCATE LI,1:COLOR 0,5:PRINT USING "¦##¦";NP;:COLOR 7,0
        IF STP=1 THEN
          ON IOP GOTO Z1,K1,N1,U1,V1
Z1:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(Z(MP,NP));Z(MP,NP);:NEXT MP:GOTO MOSTRA2
K1:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(C(MP,NP));C(MP,NP);:NEXT MP:GOTO MOSTRA2
N1:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(H(MP,NP));H(MP,NP);:NEXT MP:GOTO MOSTRA2
```

```
U1:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(U(MP,NP));U(MP,NP);:NEXT MP:GOTO MOSTRA2
V1:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(V(MP,NP));V(MP,NP);:NEXT MP:GOTO MOSTRA2
        ELSE
          ON IOP GOTO Z2,K2,N2,U2,V2
Z2:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(Z(MP,NP));Z(MP,NP);:NEXT MP:GOTO MOSTRA2
K2:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(C(MP,NP));C(MP,NP);:NEXT MP:GOTO MOSTRA2
N2:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(HP(MP,NP));HP(MP,NP);:NEXT MP:GOTO MOSTRA2
U2:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(UP(MP,NP));UP(MP,NP);:NEXT MP:GOTO MOSTRA2
V2:
          FOR MP=MPRI TO MPRI+14:PRINT USING FNORD$(VP(MP,NP));VP(MP,NP);:NEXT MP:GOTO MOSTRA2

        END IF
MOSTRA2:
      NEXT NP

      WHILE NOT INSTAT:WEND:TEC$=INKEY$

     IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="I" THEN
        NPRI=NPRI-22:IF NPRI<0 THEN NPRI=1
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="Q" THEN
        NPRI=NPRI+22:IF NPRI>NMAX-22 THEN NPRI=NMAX-21
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="s" THEN
        MPRI=MPRI-15:IF MPRI<0 THEN MPRI=1
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="t" THEN
        MPRI=MPRI+15:IF MPRI>MMAX-15 THEN MPRI=MMAX-14
        GOTO MOSTRA
      END IF

     IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="H" THEN
        NPRI=NPRI-1:IF NPRI<0 THEN NPRI=1
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="P" THEN
        NPRI=NPRI+1:IF NPRI>NMAX-22 THEN NPRI=NMAX-21
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="K" THEN
        MPRI=MPRI-1:IF MPRI<0 THEN MPRI=1
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="M" THEN
        MPRI=MPRI+1:IF MPRI>MMAX-15 THEN MPRI=MMAX-14
        GOTO MOSTRA
      END IF


      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="G" THEN
        MPRI=1:NPRI=1
        GOTO MOSTRA
      END IF

      IF LEN(TEC$)=2 AND RIGHT$(TEC$,1)="O" THEN
        MPRI=MMAX-14:IF MPRI<1 THEN MPRI=1
        NPRI=NMAX-21:IF NPRI<1 THEN NPRI=1
        GOTO MOSTRA
      END IF

      IF TEC$="U" OR TEC$="V" OR TEC$="N" OR TEC$="Z" OR TEC$="K" THEN
         FLG$=TEC$
```

```
        GOTO MOSTRA1
      END IF

      IF TEC$=CHR$(27) THEN
         ON KEY(5) GOSUB KEY5:KEY(5) ON
         LOCATE ,,0
         BLOAD "D:TEL1"
         LOCATE 23,43:PRINT SPC(35);
         LOCATE 21,31,0
         ON KEY(3) GOSUB KEY3:KEY(3) ON
         ON KEY(5) GOSUB KEY5:KEY(5) ON
         ON KEY(7) GOSUB KEY7:KEY(7) ON
         ON KEY(9) GOSUB KEY9:KEY(9) ON
         RETURN
      END IF
      GOTO MOSTRA
'.....................................................................
'            ATUALIZA VALOR DE RUGOSIDADE DE UMA LINHA
KEY7:
      KEY(3) OFF:KEY(5) OFF:KEY(9) OFF
      LOCATE 23,43:PRINT SPC(35);
      LOCATE 23,43:PRINT "LINHA:";:LINHA$=FNPPLV$(15,-1)
TOMA7:
      LOCATE 23,60:PRINT "RUGOSIDADE:";:RKNOVO=VAL(FNPPLV$(5,-1))
      IF RKNOVO=0 THEN TOMA7
          MCR=0:NCR=0:NPLR=0
          FOR L=1 TO LEN(LINHA$)
             AUX$=UCASE$(MID$(LINHA$,L,1))
             IF AUX$="X" THEN MCR=VAL(MID$(LINHA$,L+1,2))
             IF AUX$="Y" THEN NCR=VAL(MID$(LINHA$,L+1,2))
             IF AUX$="I" THEN INR=VAL(MID$(LINHA$,L+1,2))
             IF AUX$="F" THEN FIR=VAL(MID$(LINHA$,L+1,2))
             IF AUX$="D" THEN NPLR=VAL(MID$(LINHA$,L+1,2))
          NEXT L

          IF MCR>0 THEN
             FOR NCR=INR TO FICR STEP SGN(FIR-INR)
                RK(MCR,NCR)=RKNOVO
             NEXT NCR
          ELSE
             FOR MCR=INR TO FIR STEP SGN(FIR-INR)
                RK(MCR,NCR)=RKNOVO
                NCR=NCR+NPLR
             NEXT MCR
          END IF
          LOCATE 23,43:PRINT SPC(35);
          ON KEY(3) GOSUB KEY3:KEY(3) ON
          ON KEY(5) GOSUB KEY5:KEY(5) ON
          ON KEY(7) GOSUB KEY7:KEY(7) ON
          ON KEY(9) GOSUB KEY9:KEY(9) ON
          ON KEY(10) GOSUB KEY10:KEY(10) ON

      RETURN

'.....................................................................

'            atualiza arquivo de campo
KEY9:
       KEY(3) OFF:KEY(5) OFF:KEY(7) OFF:KEY(10) OFF

       LOCATE 22,3:COLOR 23,0:PRINT "ATUALIZANDO DADOS DE CAMPO";

       OPEN "R",#1,DRIVE$+ARQCAMPO$+".DCA",19

         FIELD #1,2 AS BM$,2 AS BN$,1 AS BC$,4 AS BZ$,4 AS BH$, _
               2 AS BU$,2 AS BV$,2 AS BK$

         MMAX=0:NMAX=0:RAT=10

         FOR M=1 TO ID1
            FOR N=1 TO ID2
              CA$=left$(CO$(M,N),1)
              IF CA$="T" OR CA$="H" OR CA$="I" OR CA$="U" OR CA$="V" THEN

                 LSET BM$=MKI$(M):LSET BN$=MKI$(N)
```

```
                LSET BC$=CO$(M,N)
                LSET BZ$=MKS$(Z(M,N)):LSET BH$=MKS$(H(M,N))
                LSET BU$=MKI$(INT(U(M,N)*100)):LSET BV$=MKI$(INT(V(M,N)*100))
                LSET BK$=MKI$(INT(RK(M,N)*1000))

                INCR RAT:PUT #1,RAT
                IF M>MMAX THEN MMAX=M
                IF N>NMAX THEN NMAX=N

             END IF

           NEXT N
         NEXT M

         FIELD #1, 8 AS BARQ$, 2 AS BMAX$, 2 AS BNAX$,
                                2 AS BNPON$, 4 AS BAX$, 1 AS BOB$
         LSET BARQ$=ARQCAMPO$
         LSET BMAX$=MKI$(MMAX)
         LSET BNAX$=MKI$(NMAX)
         LSET BNPON$=MKI$(RAT-10)
         LSET BAX$=MKS$(AX)
         LSET BOB$=" "
         PUT #1,1

       CLOSE #1
       LOCATE 22,3:COLOR 7,0:PRINT "ATUALIZADOS DADOS DE CAMPO";
       ON KEY(3) GOSUB KEY3:KEY(3) ON
       ON KEY(5) GOSUB KEY5:KEY(5) ON
       ON KEY(7) GOSUB KEY7:KEY(7) ON
       ON KEY(9) GOSUB KEY9:KEY(9) ON
       ON KEY(10) GOSUB KEY10:KEY(10) ON
     RETURN
'.....................................................................
ESCAPE:
      IF LINK$="TEL0" THEN STOP
      IF LINK$="TEL1" THEN
           CLOSE
           LINK$="TEL0"
           BLOAD "D:TEL0"
           GOTO TEL0
      END IF

'.....................................................................
ERRORDEALER:
       BEEP
       LOCATE 23,3:
       PRINT "ERROR:"ERR"  NO ENDERECO:"ERADR;
       WHILE NOT INSTAT:WEND:PBOB$=INKEY$
       CLOSE
       GOTO START
'.....................................................................
KEY10:

       OPEN "O",#1,DRIVEMOD$+"COMMON.MBD"
       WRITE #1,ARQCAMPO$
       WRITE #1,NARCON
       FOR I=1 TO NARCON
          WRITE #1,CON$(I),LOCON$(I)
       NEXT I
       CLOSE #1

       STOP
'.....................................................................

DEF FNORD$(X)
     IF ABS(X)<=9.99 THEN FNORD$="##.##":EXIT DEF
     IF ABS(X)<=999.9 THEN FNORD$="###.#":EXIT DEF
     FNORD$="#####"

END DEF
'.....................................................................
DEF FNC(HY,RK)
    IF HY<0 THEN HY=5
    FNC=HY^(1/6)/RK
END DEF
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'    MODELO HIDRODINAMICO BIDIMENSIONAL - MODULO DE CALCULO
'                       MODELO IMPLICITO
'                          MDBD1305
'
' MODULO       :MDBD1305.BAS
' CRIADO    EM : 22/08/1989              POR:  RODOLFO
' ATUALIZADA EM: 15/09/1989              POR:
'
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX


'.......................CALCULOS PRELIMINARES .......................

       AY       = AX

       ATX      = ATC/AX
       ATX2     = ATC/2/AX
       TATX2    = TETA*ATC/2/AX
       ATX4     = ATC/4/AX
       ATGRAVX  = ATC*GRAV/AX
       TATGRAVX = TETA*ATGRAVX

       ATY      = ATC/AY
       ATY2     = ATC/2/AY
       TATY2    = TETA*ATC/2/AY
       ATY4     = ATC/4/AY
       ATGRAVY  = ATC*GRAV/AY
       TATGRAVY = TETA*ATGRAVY

       AT8GRAV  = 8*ATC*GRAV

       FATOR  = ATC/ATD
       TEMPO  = 0


'.....................INICIALIZA ARQUIVO DE RESULTADOS.................

       LOCATE 23,42,0:COLOR 23,0:PRINT "G R A V A N D O";:COLOR 7,0

       OPEN "R",#1,DRIVESPOOL$+"MDBDRES.AUX",10
         IF LOF(1)<>0 THEN
            CLOSE #1
             SHELL "COPY "+DRIVESPOOL$+"MDBDRES.AUX "+DRIVESPOOL$+"MDBDRES.BBK >D:DUMMY"
            KILL DRIVESPOOL$+"MDBDRES.AUX"
            OPEN "R",#1,DRIVESPOOL$+"MDBDRES.AUX",10
         END IF

         FIELD #1,10 AS BTITCAMP$
           LSET BTITCAMP$=ARQCAMPO$
           PUT #1,1

           LSET BTITCAMP$=TITSIMUL$
           PUT #1,2

         FIELD #1, 2 AS BMMAX$, 2 AS BNMAX$, 4 AS BAX$, 2 AS BOP$
           LSET BMMAX$=MKI$(MMAX):LSET BNMAX$=MKI$(NMAX)
           LSET BAX$=MKS$(AX):LSET BOP$=""
           PUT #1,3

           LSET BMMAX$=MKI$(ATD):LSET BNMAX$=MKI$(ATC)
           LSET BAX$="":LSET BOP$=MKI$(IOPS)
           PUT #1,4
           RREG=4

           INCR RREG
           PREG=RREG
           NPG=0
         FIELD #1, 1 AS BM$,1 AS BN$,2 AS BU$,2 AS BV$,4 AS BH$
            FOR M=MMIN TO MMAX
               FOR N=NMIN TO NMAX
                 C$=LEFT$(CO$(M,N),1)
                 IF C$="T" OR C$="H" OR C$="U" OR C$="V" THEN
                     LSET BM$=CHR$(M):LSET BN$=CHR$(N)
                     LSET BU$=MKI$(INT(U(M,N)*100))
                     LSET BV$=MKI$(INT(V(M,N)*100))
```

```
                LSET BH$=MKS$(H(M,N))
                INCR RREG
                PUT #1,RREG
                INCR NPG
              END IF
            NEXT N
          NEXT M
        FIELD #1,4 AS BTEMPO$,2 AS BNPG$, 4 AS BOP$
          LSET BTEMPO$=MKS$(TEMPO):LSET BNPG$=MKI$(NPG):LSET BOP$=""
          PUT #1,PREG
          LOCATE 23,42,0:PRINT "              ";
      CLOSE #1


'....................... INICIO DO LOOP DE TEMPO
      ON KEY(3) GOSUB KEY3:KEY(3) ON
      ON KEY(5) GOSUB KEY5:KEY(5) ON
      ON KEY(7) GOSUB KEY7:KEY(7) ON
      ON KEY(9) GOSUB KEY9:KEY(9) ON

      DO

                        '************************
                           TEMPO=TEMPO+FATOR
                        '************************


      LOCATE 19,41:PRINT USING "CALCULANDO INSTANTE ##### s/###.### h";TEMPO$ATD;TEMPO$ATD/3600;


     '..... Inicializa os valores de UP VP E HP e zera os AU,AV,AH

      FOR II=MMIN TO MMAX
         FOR JJ=NMIN TO NMAX
            UP(II,JJ)=U(II,JJ):VP(II,JJ)=V(II,JJ):HP(II,JJ)=H(II,JJ)
         NEXT JJ
      NEXT II

      ITERA=1


REITERA:
       '...Calculo de AU e AH no Primeiro Intervalo para os M's de um N
       flitera=0

       STP=1
       LOCATE 20,41:PRINT USING "STEP=##";STP
       LOCATE 20,59:PRINT USING "ITERACAO=##";ITERA

        FOR NS=1 TO NSEC

           JJ=ASC(LEFT$(NSEC$(NS),1))
           MIN=ASC(MID$(NSEC$(NS),2,1))
           MIF=ASC(RIGHT$(NSEC$(NS),1))
           LOCATE 21,52:PRINT USING "N=###";JJ;

         '.....condicao de contorno de montante

           II=MIN:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
           C$=LEFT$(CO$(I0,JJ),1)
            LOCATE 21,42:PRINT USING "M=###";I0;

           C(II,JJ)=FNC(HP(II,JJ)-Z(II,JJ),RK(II,JJ))

           IF C$<>"H" AND C$<>"U" THEN
              R(I0)=0:S(I0)=-U(I0,JJ)
              GOTO FORPII
           ELSE
              NCONT=ASC(RIGHT$(CO$(I0,JJ),1))
              FOR LL=1 TO NPCON(NCONT)
                 XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
              NEXT LL
              FUN=FNPINT(NPCON(NCONT),TEMPO)
           END IF

           IF C$="U" THEN
              R(I0)=0:S(I0)=FUN-U(I0,JJ)
```

```
      GOTO FORPII
    END IF

    IF C$="H" THEN

      AH(I0,JJ)=FUN-H(I0,JJ)
      Q(I0)=AH(I0,JJ)
      P(I0)=0

      C(I0,JJ)=FNC(HP(I0,JJ)-Z(I0,JJ),RK(I0,JJ))

      TAL=ATGRAV *
          SQR(UP(I0,JJ)^2+(VP(II,JJ)+VP(II,J0))^2/16)/
          (C(II,JJ)+C(I0,JJ))^2/(HP(I0,JJ)+HP(II,JJ)-Z(I0,JJ)-Z(I0,J0))

      IF UP(I0,J1)=0 THEN UPI0J1=UP(I0,J0) ELSE UPI0J1=UP(I0,J1)
      IF UP(I0,J0)=0 THEN UPI0J0=UP(I0,J1) ELSE UPI0J0=UP(I0,J0)

      BBL=-TATGRAVX   :  DDL=-BBL
      CCL=1'+TAT2*(UP(II,JJ)-UP(I0,JJ))+TETA*TAL
      EEL=-ATX2*U(I0,JJ)*(UP(II,JJ)-UP(I0,JJ))-ATY/8*
          (VP(II,JJ)+VP(II,J0))*(UPI0J1+UP(I0,JJ)-UP(I0,JJ)-UPI0J0)-_
          ATGRAVX*(H(II,JJ)-H(I0,JJ))-TAL*U(I0,JJ)

      DEN=CCL+P(I0)*BBL : R(I0)=-DDL/DEN :S(I0)=(EEL-BBL*Q(I0))/DEN

      GOTO FORPII
    END IF


  '.............loop dos pontos intermediarios

  FORPII:

    FOR II=MIN TO MIF
      I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
       LOCATE 21,42:PRINT USING "M=###";II;


      IF HP(II,J1)=0 THEN HPIJ1=2*HP(II,JJ)-HP(II,J0) ELSE HPIJ1=HP(II,J1)
      IF HP(II,J0)=0 THEN HPIJ0=2*HP(II,JJ)-HP(II,J1) ELSE HPIJ0=HP(II,J0)
      IF HP(I1,JJ)=0 THEN HPI1J=2*HP(II,JJ)-HP(I0,JJ) ELSE HPI1J=HP(I1,JJ)
      IF HP(I0,JJ)=0 THEN HPI0J=2*HP(II,JJ)-HP(I1,JJ) ELSE HPI0J=HP(I0,JJ)

      AA = -TATX2*(HP(II,JJ)+HPI0J-Z(I0,JJ)-Z(I0,J0))
      BB = 1
      CC = TATX2*(HPI1J+HP(II,JJ)-Z(II,JJ)-Z(II,J0))
      DD = 0
      EE = -ATX2*U(II,JJ)*(HP(II,JJ)+HPI1J-Z(II,JJ)-Z(II,J0))+ _
           ATX2*U(I0,JJ)*(HP(II,JJ)+HPI0J-Z(I0,JJ)-Z(I0,J0)) - _
           ATY2*(HPIJ1+HP(II,JJ)-Z(II,JJ)-Z(I0,JJ))*(V(II,JJ)+TETA*AV(II,JJ))+_
           ATY2*(HP(II,JJ)+HPIJ0-Z(II,J0)-Z(I0,J0))*(V(II,J0)+TETA*AV(II,J0))

      DEN = AA*R(I0)+BB : P(II)=-CC/DEN   :Q(II)=(EE-AA*S(I0))/DEN

      IF II=MIF AND  LEFT$(CO$(I1,JJ),1)<>"H" THEN EXIT FOR

      C(I1,JJ)=FNC(HP(I1,JJ)-Z(I1,JJ),RK(I1,JJ))
      TAL=ATGRAV *
          SQR(UP(II,JJ)^2+(VP(I1,JJ)+VP(II,JJ)+VP(II,J0)+VP(I1,J0))^2/16)/_
          (C(II,JJ)+C(II,JJ))^2/(HP(II,JJ)+HP(I1,JJ)-Z(II,JJ)-Z(II,J0))

      IF UP(II,J1)=0 THEN UPIJ1=UP(II,J0) ELSE UPIJ1=UP(II,J1)
      IF UP(II,J0)=0 THEN UPIJ0=UP(II,J1) ELSE UPIJ0=UP(II,J0)

      BBL=-TATGRAVX   :  DDL=-BBL
      CCL=1+TATX2*(UP(I1,JJ)-UP(I0,JJ))+TETA*TAL
      EEL=-ATX2*U(II,JJ)*(UP(I1,JJ)-UP(I0,JJ))-ATY/8*
          (VP(I1,JJ)+VP(II,JJ)+VP(II,J0)+VP(I1,J0))*(UPIJ1+UP(II,JJ)-UP(II,JJ)-UPIJ0)-_
          ATGRAVX*(H(I1,JJ)-H(II,JJ))-U(II,JJ)*TAL

      DEN = BBL*P(II)+CCL : R(II)=-DDL/DEN : S(II)=(EEL-BBL*Q(II))/DEN


    NEXT II
```

```
'..... condicao de contorno de jusante

   II=MIF:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
   C$=LEFT$(CO$(I1,JJ),1)
    LOCATE 21,42:PRINT USING "M=###";I1;

   IF C$<>"H" AND C$<>"U" THEN
      UP(I1,JJ)=0
      AU(II,JJ)=-U(II,JJ)
      GOTO FORHUII
   ELSE
      NCONT=ASC(RIGHT$(CO$(I1,JJ),1))
      FOR LL=1 TO NPCON(NCONT)
         XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
   END IF

   IF C$="U" THEN
      AU(II,JJ)=FUN-U(II,JJ)
      GOTO FORHUII
   END IF

   IF C$="H" THEN
      AH(I1,JJ)=FUN-H(I1,JJ)
      AU(II,JJ)=R(II)*AH(I1,JJ)+S(II)
      GOTO FORHUII
   END IF

'.....calculo dos AH e AU nas linhas N

FORHUII:
   FOR II=MIF TO MIN STEP -1
      AH(II,JJ)=P(II)*AU(II,JJ)+Q(II)
      AU(II-1,JJ)=R(II-1)*AH(II,JJ)+S(II-1)
   NEXT II

NEXT NS

'.........Calculo dos HP,UP  no 1o. STEP

FOR II=MMIN TO MMAX
   FOR JJ=NMIN TO NMAX
      if abs(Up(ii,jj)-teta*aU(ii,jj)-U(ii,jj))>.0050 then flitera=1
      UP(II,JJ)=U(II,JJ)+TETA*AU(II,JJ)
      HP(II,JJ)=H(II,JJ)+TETA*AH(II,JJ)
   NEXT JJ
NEXT II


STP=2
LOCATE 20,41:PRINT USING "STEP=##";STP

'...Calculo de AV e AH no Segundo Intervalo para os N's de um M

 FOR MS=1 TO MSEC

    II=ASC(LEFT$(MSEC$(MS),1))
    NIN=ASC(MID$(MSEC$(MS),2,1))
    NIF=ASC(RIGHT$(MSEC$(MS),1))
    LOCATE 21,42:PRINT USING "M=###";II;

 '.....contorno de montante

    JJ=NIN:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
    C$=LEFT$(CO$(II,J0),1)
     LOCATE 21,52:PRINT USING "N=###";J0;

    C(II,JJ)=FNC(HP(II,JJ)-Z(II,JJ),RK(II,JJ))

    IF C$<>"H" AND C$<>"V" THEN
       R(J0)=0:S(J0)=-V(II,J0)
       GOTO FORPJJ
    ELSE
       NCONT=ASC(RIGHT$(CO$(II,J0),1))
       FOR LL=1 TO NPCON(NCONT)
```

```
        XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
    END IF

    IF C$="V" THEN
      R(J0)=0:S(J0)=FUN-V(II,J0)
      GOTO FORPJJ
    END IF

    IF C$="H" THEN

      AH(II,J0)=FUN-H(II,J0)
      Q(J0)=AH(II,J0)
      P(J0)=0

      C(II,J0)=FNC(HP(II,J0)-Z(II,J0),RK(II,J0))
      TAL=ATBGRAV *
          SQR(VP(II,J0)^2+(UP(II,JJ)+UP(I0,JJ))^2/16)/
          (C(II,JJ)+C(II,J0))^2/(HP(II,JJ)+HP(II,J0)-Z(II,J0)-Z(I0,J0))

      IF VP(I1,J0)=0 THEN VPI1J0=VP(I0,J0) ELSE VPI1J0=VP(I1,J0)
      IF VP(I0,J0)=0 THEN VPI0J0=VP(I1,J0) ELSE VPI0J0=VP(I0,J0)

      BBL=-TATGRAVY   :  DDL=-BBL
      CCL=1'+TAT2*(VP(II,JJ)-VP(II,J0))+TETA*TAL
      EEL=-ATY2*U(II,J0)*(VP(II,JJ)-VP(II,J0))-ATX/8*
          (UP(II,JJ)+UP(I0,JJ))*(VPI1J0+VP(II,J0)-VP(I1,J0)-VPI0J0)-_
          ATGRAVY*(H(II,JJ)-H(II,J0))-TAL*V(II,J0)

      DEN=CCL+P(J0)*BBL : R(J0)=-DDL/DEN :S(J0)=(EEL-BBL*Q(J0))/DEN

      GOTO FORPJJ
    END IF


'.............loop dos pontos intermediarios

FORPJJ:

    FOR JJ=NIN TO NIF
      J0=JJ-1:J1=JJ+1
       LOCATE 21,52:PRINT USING "N=###";JJ;

      IF HP(II,J1)=0 THEN HPIJ1=2*HP(II,JJ)-HP(II,J0) ELSE HPIJ1=HP(II,J1)
      IF HP(II,J0)=0 THEN HPIJ0=2*HP(II,JJ)-HP(II,J1) ELSE HPIJ0=HP(II,J0)
      IF HP(I1,JJ)=0 THEN HPI1J=2*HP(II,JJ)-HP(I0,JJ) ELSE HPI1J=HP(I1,JJ)
      IF HP(I0,JJ)=0 THEN HPI0J=2*HP(II,JJ)-HP(I1,JJ) ELSE HPI0J=HP(I0,JJ)

      AA = -TATY2*(HP(II,JJ)+HPIJ0-Z(II,J0)-Z(I0,J0))
      BB = 1
      CC = TATY2*(HPIJ1+HP(II,JJ)-Z(II,JJ)-Z(I0,JJ))
      DD = 0
      EE = -ATY2*V(II,JJ)*(HP(II,JJ)+HPIJ1-Z(II,JJ)-Z(I0,JJ))+ _
           ATY2*V(II,J0)*(HP(II,JJ)+HPIJ0-Z(II,J0)-Z(I0,J0)) - _
           ATX2*(HPI1J+HP(II,JJ)-Z(II,JJ)-Z(II,J0))*(U(II,JJ)+TETA*AU(II,JJ))+_
           ATX2*(HP(II,JJ)+HPI0J-Z(I0,JJ)-Z(I0,J0))*(U(I0,JJ)+TETA*AU(I0,JJ))

      DEN = AA*R(J0)+BB : P(JJ)=-CC/DEN   :Q(JJ)=(EE-AA*S(J0))/DEN

      IF JJ=NIF AND  LEFT$(CO$(II,J1),1)<>"H" THEN EXIT FOR

      C(II,J1)=FNC(HP(II,J1)-Z(II,J1),RK(II,J1))
      TAL=ATBGRAV *
          SQR(VP(II,JJ)^2+(UP(II,JJ)+UP(II,J1)+UP(I0,JJ)+UP(I0,J1))^2/16)/_
          (C(II,J1)+C(II,JJ))^2/(HP(II,J1)+HP(II,JJ)-Z(II,JJ)-Z(I0,JJ))

      IF VP(I1,JJ)=0 THEN VPI1J=VP(I0,JJ) ELSE VPI1J=VP(I1,JJ)
      IF VP(I0,JJ)=0 THEN VPI0J=VP(I1,JJ) ELSE VPI0J=VP(I0,JJ)


      BBL=-TATGRAVY   :  DDL=-BBL
      CCL=1+TATY2*(VP(II,J1)-VP(II,J0))+TETA*TAL
      EEL=-ATY2*V(II,JJ)*(VP(II,J1)-VP(II,J0))-ATX/8*
          (UP(II,JJ)+UP(II,J1)+UP(I0,JJ)+UP(I0,J1))*(VPI1J+VP(II,JJ)-VP(II,JJ)-VPI0J)-_
          ATGRAVY*(H(II,J1)-H(II,JJ))-V(II,JJ)*TAL
```

```
      DEN = BBL#P(JJ)+CCL : R(JJ)=-DDL/DEN : S(JJ)=(EEL-BBL#Q(JJ))/DEN

    NEXT JJ


  '.....condicao de contorno de jusante

    JJ=NIF:J0=JJ-1:J1=JJ+1
    C$=LEFT$(CO$(II,J1),1)
     LOCATE 21,52:PRINT USING "N=###";J1;

    IF C$<>"H" AND C$<>"V" THEN
       VP(II,J1)=0
       AV(II,JJ)=-V(II,JJ)
       GOTO FORHUJJ
    ELSE
       NCONT=ASC(RIGHT$(CO$(II,J1),1))
       FOR LL=1 TO NPCON(NCONT)
          XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
       NEXT LL
       FUN=FNPINT(NPCON(NCONT),TEMPO)
    END IF

    IF C$="V" THEN
       AV(II,JJ)=FUN-V(II,JJ)
       GOTO FORHUJJ
    END IF

    IF C$="H" THEN
       AH(II,J1)=FUN-H(II,J1)
       AV(II,JJ)=R(JJ)#AH(II,J1)+S(JJ)
       GOTO FORHUJJ
    END IF


  '.....calculo dos AH e AV na Coluna M

  FORHUJJ:
     FOR JJ=NIF TO NIN STEP -1
        AH(II,JJ)=P(JJ)#AV(II,JJ)+Q(JJ)
        AV(II,JJ-1)=R(JJ-1)#AH(II,JJ)+S(JJ-1)
     NEXT JJ

  NEXT MS

  '.........Calculo dos HP,VP  no 2o. STEP

  FOR II=MMIN TO MMAX
     FOR JJ=NMIN TO NMAX
        if abs(Vp(ii,jj)-teta#aV(ii,jj)-V(ii,jj))>.010 then flitera=1
        VP(II,JJ)=V(II,JJ)+TETA#AV(II,JJ)
        HP(II,JJ)=H(II,JJ)+TETA#AH(II,JJ)
     NEXT JJ
  NEXT II



  '..Verifica Necessidade de iteracao
     IF flitera=1 and ITERA<NITERA THEN ITERA=ITERA+1:GOTO REITERA


  '.........Calculo dos H, U e V  Finais

  FOR II=MMIN TO MMAX
     FOR JJ=NMIN TO NMAX
        U(II,JJ)=U(II,JJ)+AU(II,JJ)
        V(II,JJ)=V(II,JJ)+AV(II,JJ)
        H(II,JJ)=H(II,JJ)+AH(II,JJ)
        AU(II,JJ)=0:AV(II,JJ)=0:AH(II,JJ)=0
     NEXT JJ
  NEXT II

 '......Guarda Resultados no Arquivo Auxiliar
  KEY(3) OFF:KEY(5) OFF:KEY(7) OFF:KEY(9) OFF:KEY(10) OFF

  IF INT(TEMPO/FATOR+.1) MOD IOPS =0 THEN
     SOUND 512,1
```

```
            LOCATE 23,42,0:COLOR 23,0:PRINT "G R A V A N D O";:COLOR 7,0

            OPEN "R",#1,DRIVESPOOL$+"MDBDRES.AUX",10

            INCR RREG
            PREG=RREG
            NPG=0
            FIELD #1, 1 AS BM$,1 AS BN$,2 AS BU$,2 AS BV$,4 AS BH$
            FOR M=MMIN TO MMAX
               FOR N=NMIN TO NMAX
                 C$=LEFT$(CO$(M,N),1)
                 IF C$="T" OR C$="H" OR C$="U" OR C$="V" THEN
                     LSET BM$=CHR$(M):LSET BN$=CHR$(N)
                     LSET BU$=MKI$(INT(U(M,N)*100))
                     LSET BV$=MKI$(INT(V(M,N)*100))
                     LSET BH$=MKS$(H(M,N))
                     INCR RREG
                     PUT #1,RREG
                     INCR NPG
                 END IF
               NEXT N
            NEXT M
            FIELD #1,4 AS BTEMPO$,2 AS BNPG$, 4 AS BOP$
              LSET BTEMPO$=MKS$(TEMPO):LSET BNPG$=MKI$(NPG):LSET BOP$=""
              PUT #1,PREG
            CLOSE #1
            LOCATE 23,42:PRINT "              ";
          END IF
          ON KEY(3) GOSUB KEY3:KEY(3) ON
          ON KEY(5) GOSUB KEY5:KEY(5) ON
          ON KEY(7) GOSUB KEY7:KEY(7) ON
          ON KEY(9) GOSUB KEY9:KEY(9) ON
          ON KEY(10) GOSUB KEY10:KEY(10) ON

'.........TERMINO DO LOOP DE TEMPO

     LOOP UNTIL TEMPO >XBMAX

'.....................................................................
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'          FUNCAO PARA FORMATACAO DE SAIDAS EM FUNCAO DA
'                       ORDEM DE GRANDEZA
'
'CRIADA EM:                                  POR: FRANCISCO
'MODULO   : MDBD1401.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX



DEF FNORD$(X,NPOS)

     IF X=0 THEN IND=2:GOTO 4310
     IND=INT(LOG10(ABS(X))+1)
     IF IND<0 THEN IND=0
     IND=IND+1
     IF X<0 THEN IND=IND+1
     IF IND>=NPOS THEN FNORD$=STRING$(NPOS,"#"):EXIT DEF
4310 FNORD$=LEFT$(STRING$(IND,"#")+"."+STRING$(NPOS-IND-1,"#"),NPOS)

END DEF
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'                     FUNCAO DISPLAY MENU
'                     MODULO: MDBD1501.BAS
'
'CRIADO     EM:10/06/1988                          POR: RODOLFO
'ATUALIZADO EM:28-08-89                            POR: RODOLFO
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

DEF FNMENU(NOP,LIIN,COLIN,COMPRI,TI$)

     SHARED ITEM$()

     IF (COLIN MOD 2)<>0 THEN COLIN=(COLIN\2)*2
     CALL BOX(LIIN,(COMPRI-LEN(TI$))\2+COLIN,LEN(TI$),0)
     COLOR 7,0:PRINT TI$:COLOR 7,0
     ICUR=LIIN+2:LOCATE ICUR,COLIN-2
     PRINT "┌";STRING$(COMPRI+1,205);"┐";
     FOR I=1 TO NOP
        LOCATE ICUR+I,COLIN-2:PRINT "│";STRING$(COMPRI+1,32);"│";
     NEXT I
     LOCATE ICUR+NOP+1,COLIN-2:PRINT "└";STRING$(COMPRI+1,205);"┘";

     FOR I=1 TO NOP
        ICUR=ICUR+1
        LOCATE ICUR,COLIN,0:PRINT ITEM$(I)
     NEXT I

     ICURANT=LIIN+3 : ICUR=LIIN+3 :IOPT=1
     LOCATE ICUR,COLIN:COLOR 0,7:PRINT ITEM$(IOPT)
     COLOR 7,0
1    CUR$=INKEY$:IF CUR$="" THEN 1
     IF CUR$=CHR$(32) OR (LEN(CUR$)=2 AND HEX$(ASC(RIGHT$(CUR$,1)))="50") THEN
          ICURANT=ICUR
          LOCATE ICURANT,COLIN:COLOR 7,0:PRINT ITEM$(IOPT)
          ICUR=ICUR+1:IOPT=IOPT+1:IF ICUR>LIIN+2 +NOP THEN ICUR=LIIN+3:IOPT=1
          LOCATE ICUR,COLIN:COLOR 0,7:PRINT ITEM$(IOPT)
          COLOR 7,0
          GOTO 1
     END IF
     IF  (LEN(CUR$)=2 AND HEX$(ASC(RIGHT$(CUR$,1)))="48") THEN
          ICURANT=ICUR
          LOCATE ICURANT,COLIN:COLOR 7,0:PRINT ITEM$(IOPT)
          ICUR=ICUR-1:IOPT=IOPT-1
          IF ICUR<LIIN+3 THEN ICUR=LIIN+2+NOP:IOPT=NOP
          LOCATE ICUR,COLIN:COLOR 0,7:PRINT ITEM$(IOPT)
          COLOR 7,0
          GOTO 1
     END IF

     IF CUR$=CHR$(13) THEN 2
     GOTO 1
2    ICUR=LIIN+2:LOCATE ICUR,COLIN-2
     PRINT "┌";STRING$(COMPRI+1,196);"┐";
     FOR I=1 TO NOP
        LOCATE ICUR+I,COLIN-2:PRINT "│";
        LOCATE ICUR+I,COLIN+COMPRI:PRINT "│";

     NEXT I
     LOCATE ICUR+NOP+1,COLIN-2:PRINT "└";STRING$(COMPRI+1,196);"┘";
     FNMENU=IOPT
END DEF
```

```
'.....................................................................
'
'   MODELO HIDRODINAMICO BIDIMENSIONAL - PLOTAGEM DAS VELOCIDADES E NIVEIS
'                          MDBD1602
'
'
'CRIADO     EM:28/08/1989          POR:RODOLFO
'ATUALIZADO EM:
'MODULO       :MDBD1602.BAS
'.....................................................................

SUB PLOT(ESCU,ESCV,IPAR,LIG)

      SHARED MMAX,NMAX,AX,AY,MSEC,NSEC,TEMPO
      SHARED DRIVEMOD$,ARQCAMPO$,DIA$
      SHARED CO$(),NSEC$(),MSEC$()
      SHARED U(),V(),H()

      LOCAL I,J,MS,NS,MIN,MIF,NIN,NIF,ISTPX,ISTPY,IPI,IPJ
      LOCAL ANGU, COTAMAX, COTAMIN, COTA
      LOCAL SIMBH$,SIMBT$,SIMBU$,SIMBV$,SIMBS$,VAR$,TEMPO$,C$

      PI=4*ATN(1)

      SIMBH$="N U1 N D1 L2 R4"
      SIMBT$="L1 D1 R2 U1 L1"
      SIMBU$="L2 R4 L2"
      SIMBV$="U2 D3 U1"
      SIMBS$="N H1 N G1 TA"

      SCREEN 2
      DEF SEG=&HB800
      BLOAD DRIVEMOD$+"TELPLOT.MBD"

      ISTPX=609\MMAX:ISTPY=170\NMAX
      IF ISTPX\ISTPY<2 THEN ISTPY=ISTPX\2

      FOR I=20 TO 629 STEP ISTPX*2:LINE (I,19)-(I,22):NEXT I
      FOR I=20 TO 190 STEP ISTPY*2:LINE (18,I)-(23,I):NEXT I

      FOR I=20 TO 629 STEP ISTPX
         FOR J=20 TO 190 STEP ISTPY
           PSET (I,J)
         NEXT J
      NEXT I

      FOR I=20 TO 629 STEP ISTPX*10
           CALL DRAWSTRING(I-6,14,1,STR$((I-20)\ISTPX))
           LINE (I-1,19)-(I-1,22)
      NEXT I
      FOR I=20 TO 180 STEP ISTPY*10
      CALL DRAWSTRING(0,I-3,1,STR$((I-20)\ISTPY))
      LINE (18,I-1)-(23,I-1)
      NEXT I

      VAR$=LEFT$(STR$(AX)+"      ",5)
      CALL DRAWSTRING(4,195,1,"Esc X ="+VAR$+" m ")
      LINE (93,192)-(93,199)
      VAR$=LEFT$(STR$(AY)+"      ",5)
      CALL DRAWSTRING(104,195,1,"Esc Y ="+VAR$+" m ")
      LINE (197,192)-(197,199)


      CALL DRAWSTRING(455,195,1,"*MDBD*   "+DIA$)
      CALL DRAWSTRING(80,4,2,ARQCAMPO$)
      TEMPO$=LEFT$(STR$(TEMPO),5)
      CALL DRAWSTRING(250,4,1,"INSTANTE :"+TEMPO$+"  h" )

      FOR NS=1 TO NSEC
         J=ASC(LEFT$(NSEC$(NS),1))
         MIN=ASC(MID$(NSEC$(NS),2,1))
         MIF=ASC(RIGHT$(NSEC$(NS),1))
         C$=LEFT$(CO$(MIN-1,J),1)
         IF C$="H" OR C$="U" OR C$="V" THEN
             IF C$="H" THEN PSET (20+MIN*ISTPX-ISTPX,20+J*ISTPY):DRAW SIMBH$
             IF C$="U" THEN PSET (20+MIN*ISTPX-ISTPX,20+J*ISTPY):DRAW SIMBU$
             IF C$="V" THEN PSET (20+MIN*ISTPX-ISTPX,20+J*ISTPY):DRAW SIMBV$
```

```
        ELSE
            PSET (20+MIN*ISTPX-ISTPX\2,20+J*ISTPY):DRAW SIMBT$
        END IF

        C$=LEFT$(CO$(MIF+1,J),1)
        IF C$="H" OR C$="U" OR C$="V" THEN
            IF C$="H" THEN PSET (20+MIF*ISTPX+ISTPX,20+J*ISTPY):DRAW SIMBH$
            IF C$="U" THEN PSET (20+MIF*ISTPX+ISTPX,20+J*ISTPY):DRAW SIMBU$
            IF C$="V" THEN PSET (20+MIF*ISTPX+ISTPX,20+J*ISTPY):DRAW SIMBV$
        ELSE
            PSET (20+MIF*ISTPX+ISTPX\2,20+J*ISTPY):DRAW SIMBT$
        END IF
      NEXT NS
      FOR MS=1 TO MSEC
        I=ASC(LEFT$(MSEC$(MS),1))
        NIN=ASC(MID$(MSEC$(MS),2,1))
        NIF=ASC(RIGHT$(MSEC$(MS),1))
        C$=LEFT$(CO$(I,NIN-1),1)
        IF C$="H" OR C$="U" OR C$="V" THEN
            IF C$="H" THEN PSET (20+I*ISTPX,20+NIN*ISTPY-ISTPY):DRAW SIMBH$
            IF C$="U" THEN PSET (20+I*ISTPX,20+NIN*ISTPY-ISTPY):DRAW SIMBU$
            IF C$="V" THEN PSET (20+I*ISTPX,20+NIN*ISTPY-ISTPY):DRAW SIMBV$
        ELSE
            PSET (20+I*ISTPX,20+NIN*ISTPY-ISTPY\2):DRAW SIMBT$
        END IF
        C$=LEFT$(CO$(I,NIF+1),1)
        IF C$="H" OR C$="U" OR C$="V" THEN
            IF C$="H" THEN PSET (20+I*ISTPX,20+NIF*ISTPY+ISTPY):DRAW SIMBH$
            IF C$="U" THEN PSET (20+I*ISTPX,20+NIF*ISTPY+ISTPY):DRAW SIMBU$
            IF C$="V" THEN PSET (20+I*ISTPX,20+NIF*ISTPY+ISTPY):DRAW SIMBV$
        ELSE
            PSET (20+I*ISTPX,20+NIF*ISTPY+ISTPY\2):DRAW SIMBT$
        END IF
      NEXT MS

      IF LIG<>1 THEN CNIVEL:

        VAR$=LEFT$(STR$(ESCU)+"      ",5)
        CALL DRAWSTRING(210,195,1,"Esc U ="+VAR$+" m/s ")
        LINE (313,192)-(313,199)
        VAR$=LEFT$(STR$(ESCV)+"      ",5)
        CALL DRAWSTRING(323,195,1,"Esc V ="+VAR$+" m/s ")
        LINE (425,192)-(425,199)

      ESCU=ESCU/ISTPX:ESCV=ESCV/ISTPY
      FOR NS=1 TO NSEC
        J=ASC(LEFT$(NSEC$(NS),1))
        MIN=ASC(MID$(NSEC$(NS),2,1))
        MIF=ASC(RIGHT$(NSEC$(NS),1))
        FOR I=MIN TO MIF STEP IPAR
          LINE (20+I*ISTPX,20+J*ISTPY)-(20+I*ISTPX+U(I,J)/ESCU,20+J*ISTPY+V(I,J)/ESCV)
        NEXT I
      NEXT NS
      EXIT SUB


CNIVEL:

      VAR$=LEFT$(STR$(ESCU)+"      ",5)
        CALL DRAWSTRING(210,195,1,"Eqd N.A. ="+VAR$+"  m  ")
        LINE (320,192)-(320,199)

      COTAMAX=-1E6:COTAMIN=1E6
      FOR NS=1 TO NSEC
        J=ASC(LEFT$(NSEC$(NS),1))
        MIN=ASC(MID$(NSEC$(NS),2,1))
        MIF=ASC(RIGHT$(NSEC$(NS),1))
        FOR I=MIN TO MIF
          IF H(I,J)>COTAMAX THEN COTAMAX=H(I,J)
          IF H(I,J)<COTAMIN THEN COTAMIN=H(I,J)
        NEXT I
      NEXT NS

        IORDEM=ABS(LOG10(ESCU))':IF IORDEM<0 THEN IORDEM=0
        COTAMIN=INT(COTAMIN*10^IORDEM)/10^IORDEM

       FOR COTA=COTAMIN TO COTAMAX STEP ESCU
```

```
        FLL=0
        FOR NS=1 TO NSEC
           J=ASC(LEFT$(NSEC$(NS),1))
           MIN=ASC(MID$(NSEC$(NS),2,1))
           MIF=ASC(RIGHT$(NSEC$(NS),1))
           FOR I=MIN TO MIF
           IF INKEY$=CHR$(27) THEN EXIT SUB

           IF COTA > H(I,J) AND COTA < H(I+1,J) THEN
              C$=LEFT$(CO$(I+1,J),1)
              IF C$ <>"T" AND C$<>"H" THEN  EXIT IF
              IPJ = 20+J*ISTPY
              IPI = 20+I*ISTPX+ISTPX/(H(I+1,J)-H(I,J))*(COTA-H(I,J))
              CIRCLE (IPI,IPJ),1
              IF FLL=0 THEN CALL DRAWSTRING (IPI+4,IPJ+2,1,MID$(STR$(COTA),2,5)):FLL=1
           END IF

           IF COTA < H(I,J) AND COTA > H(I+1,J) THEN
              C$=LEFT$(CO$(I+1,J),1)
              IF C$ <>"T" AND C$<>"H" THEN  EXIT IF
              IPJ = 20+J*ISTPY
              IPI = 20+I*ISTPX+ISTPX/(H(I,J)-H(I+1,J))*(COTA-H(I+1,J))
              CIRCLE (IPI,IPJ),1
              IF FLL=0 THEN CALL DRAWSTRING (IPI+4,IPJ+2,1,MID$(STR$(COTA),2,5)):FLL=1
           END IF

           IF COTA > H(I,J) AND COTA < H(I,J+1) THEN
              C$=LEFT$(CO$(I,J+1),1)
              IF C$ <>"T" AND C$<>"H" THEN  EXIT IF
              IPI = 20+I*ISTPX
              IPJ = 20+J*ISTPY+ISTPY/(H(I,J+1)-H(I,J))*(COTA-H(I,J))
              CIRCLE (IPI,IPJ),1
              IF FLL=0 THEN CALL DRAWSTRING (IPI+4,IPJ+2,1,MID$(STR$(COTA),2,5)):FLL=1
           END IF

           IF COTA < H(I,J) AND COTA > H(I,J+1) THEN
              C$=LEFT$(CO$(I,J+1),1)
              IF C$ <>"T" AND C$<>"H" THEN  EXIT IF
              IPI = 20+I*ISTPX
              IPJ = 20+J*ISTPY+ISTPY/(H(I,J)-H(I,J+1))*(COTA-H(I,J+1))
              CIRCLE (IPI,IPJ),1
              IF FLL=0 THEN CALL DRAWSTRING (IPI+4,IPJ+2,1,MID$(STR$(COTA),2,5)):FLL=1
           END IF

         NEXT I
        NEXT NS

       NEXT COTA

END SUB
'.....................................................................
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'                  MODELO HIDRODINAMICO BIDIMENSIONAL
'                       MODULO DE  RESULTADOS
'                           MDBD1703
'
' CRIADO     EM:28/08/1989                    POR: RODOLFO
' ATUALIZADO EM:
' MODULO:MDBD1703.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

'.............................PARAMETROS DO SISTEMA.....................

'       CLEAR

        DEFINT I-N
        DEFSNG A-H,O-Z

        '..........DIMENSIONAMENTO DAS VARIAVEIS
        ID1= 74          'numero maximo de pontos em x
        ID2= 40          'numero maximo de pontos em y
        ID3= 24          'numero maximo de intervalos de tempo de dados
        ID4= 10          'numero maximo de arquivos de condicoes de contorno

        DIM PALMAT$(40),CO$(ID1,ID2),MSEC$(2*ID2),NSEC$(2*ID1)
        DIM CHAR$(128),ITEM$(10)

        DIM Z(ID1,ID2),H(ID1,ID2),U(ID1,ID2),V(ID1,ID2),RK(ID1,ID2)
        DIM C(ID1,ID2),VAZOES(200),TEMPOS(200)


        '...........PARAMETROS AUXILIARES PROVISORIOS

        DRIVE$="C:\MDBD\DADOS\":DRIVEMOD$="C:\MDBD\":DRIVESPOOL$="C:\MDBD\SPOOL\"
        MAXLIN=75:ICARACLIN=80:ICARACPOL=8:ITAMPG=80
        DIA$=MID$(DATE$,4,2)+"/"+LEFT$(DATE$,2)+"/"+RIGHT$(DATE$,4)
        NUMLI=0:IPAG=0:ARQ$=""
        PI=4*ATN(1)

'...................INCLUDE SUBROTINAS..............................

$INCLUDE "MDBD0101.BAS"  'FNPPLV$
$INCLUDE "MDBD0201.BAS"  'PAGINA
$INCLUDE "MDBD0301.BAS"  'DRAWSTRING
$INCLUDE "MDBD0601.BAS"  'SAVETELA
$INCLUDE "MDBD0901.BAS"  'HEADER
$INCLUDE "MDBD1401.BAS"  'FNORD
$INCLUDE "MDBD1501.BAS"  'FNMENU
$INCLUDE "MDBD1602.BAS"  'PLOT
$INCLUDE "MDBD1801.BAS"  'GRAFICO
$INCLUDE "MDBD2301.BAS"  'BOX

'
'    ---------------CARREGA FONTES-------------

     OPEN "I",#18,DRIVEMOD$+"MDBD4X6.FON"
     WHILE NOT EOF(18)
        LINE INPUT #18,A$
        CHAR$(VAL(MID$(A$,1,4)))=RIGHT$(A$,LEN(A$)-4)
     WEND
     CLOSE #18
'*****************************************************************'
'
'
'
'.................................................................
'               PROGRAMA PRINCIPAL

        ON ERROR GOTO ERRORDEALER
        ON KEY(10) GOSUB KEY10:KEY(10) ON
        LINK$="TELO"
        CALL PAGINA("MODELO BIDIMENSIONAL  -  RESULTADOS")

'.....................ENTRADA DE DADOS GERAIS ..................
TELO:
```

```
        ARQ$=COMMAND$
        IF ARQ$="" THEN
          LOCATE 5,3:LOCATE 5,3:PRINT "NOME DO ARQUIVO:";:ARQ$=FNPPLV$(12,-1)
          IF ARQ$=CHR$(27) THEN ESCAPE
          IF UCASE$(ARQ$)="D" THEN DIRETORIO
          IF ARQ$="" THEN ARQ$="MDBDRES.AUX"
        END IF

        OPEN "R",#1,DRIVESPOOL$+ARQ$,10
        IF LOF(1)=0 THEN
           BEEP
           LOCATE 5,3:PRINT "ARQUIVO DE RESULTADOS NAO EXISTE"
           CLOSE #1
           GOTO TELO
        END IF

        TREG=LOF(1)/10
        FIELD #1,10 AS BTITCAMP$
           GET #1,1:ARQCAMPO$=BTITCAMP$
           GET #1,2:TITSIMUL$=BTITCAMP$
           GET #1,3:RG$=BTITCAMP$
             MMAX=CVI(LEFT$(RG$,2)):NMAX=CVI(MID$(RG$,3,2))
             AX=CVS(MID$(RG$,5,4))
             AY=AX
           GET #1,4:RG$=BTITCAMP$
             ATD=CVI(LEFT$(RG$,2)):ATC=CVI(MID$(RG$,3,2))
             IOPS=CVI(RIGHT$(RG$,2))


10      LOCATE 5,3:PRINT        "NOME DO ARQUIVO       :";ARQCAMPO$
30      LOCATE 6,3:PRINT  USING "No DE PONTOS EM X      :#####";MMAX
40      LOCATE 7,3:PRINT  USING "No DE PONTOS EM Y      :#####";NMAX
50      LOCATE 8,3:PRINT  USING "COMPRIMENTO DA MALHA   :#####";AX
60      LOCATE 9,3:PRINT  USING "TITULO DA MALHA        :&";LEFT$(TITCAMPO$,13);
80      LOCATE 11,3:PRINT USING "TEMPO DOS DADOS        :####";ATD
90      LOCATE 12,3:PRINT USING "TEMPO DOS CALCULOS     :####";ATC
        LOCATE 13,3:PRINT USING "INTERVALO DE SAIDA     :####";IOPS
100     LOCATE 14,3:PRINT       "TITULO DA SIMULACAO    :";
        LOCATE 15,3:PRINT TITSIMUL$
        LOCATE 17,3:PRINT STRING$(76,205)

        FOR I=5 TO 22 :LOCATE I,40:PRINT "|":NEXT I

'................... Le o Arquivo de Campo


        LOCATE 18,3:COLOR 23,0
        PRINT "LEITURA DOS DADOS DE CAMPO":COLOR 7,0
        GOSUB LEITURA
        LOCATE 18,3:PRINT "LEITURA DOS DADOS DE CAMPO"
        LOCATE 19,3:COLOR 23,0
        PRINT "SCANING":COLOR 7,0
        GOSUB SCANNING
        LOCATE 19,3:PRINT "SCANING"


        ITEM$(2)="LISTAGEM INSTANTANEA"
        ITEM$(3)="  VELOCIGRAMAS  X   "
        ITEM$(4)="  VELOCIGRAMAS  Y   "
        ITEM$(5)="    LIMNIGRAMAS     "
        ITEM$(1)=" MAPA VELOCIMETRICO "
        ITEM$(6)="VEL. MODULO-DIRECAO "
        ITEM$(7)="    HIDROGRAMAS     "
        ITEM$(8)="   CURVA DE NIVEL   "

MENU:
        IOPT=FNMENU(8,5,50,20,"  RESULTADOS  ")

        ON IOPT GOTO MAPA,LISTIN,VEL,VEL,VEL,MODIR,HIDRO,CUNI

        GOTO ESCAPE

'*************************************************************************
'                       MAPA VELOCIMETRICO
'           PLOTA VALORES DO CAMPO DE VELOCIDADES
MAPA:
        DEF SEG=&HB800
```

```
      BSAVE "D:TELO",0,4000
TOMA1:
      LOCATE 19,41:PRINT "INSTANTE:";:T$=FNPPLV$(4,-1)
      IF T$=CHR$(27) THEN VOLTA ELSE TT=VAL(T$)

      '..................... Le os Dados
      RREG=4
      FIELD #1,10 AS BRG$
      WHILE RREG<TREG
        IF INKEY$=CHR$(27) THEN VOLTA
        INCR RREG:GET #1,RREG:RG$=BRG$
        TEMPO=CVS(LEFT$(RG$,4)):NPG=CVI(MID$(RG$,5,2))
        IF  ABS(TEMPO-TT)<.001 THEN PLOT ELSE RREG=RREG+NPG
      WEND
      BEEP:LOCATE 23,41:PRINT "INTERVALO NAO EXISTE"
      DELAY 1
      GOTO VOLTA
PLOT:
      FOR RI=RREG+1 TO RREG + NPG
          GET #1,RI
          M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
          U(M,N)=CSNG(CVI(MID$(BRG$,3,2)))/100
          V(M,N)=CSNG(CVI(MID$(BRG$,5,2)))/100
          IF INKEY$=CHR$(27) THEN VOLTA
      NEXT RI
PLOT1:
      LOCATE 20,41:PRINT "ESCALA U:";:ES$=FNPPLV$(4,-1)
      IF ES$=CHR$(27) THEN TOMA1 ELSE ESCU=VAL(ES$)
      LOCATE 21,41:PRINT "ESCALA V:";:ESCV=VAL(FNPPLV$(4,-1))
      IF ESCU=0 OR ESCV=0 THEN TOMA1
      CALL PLOT(ESCU,ESCV,1,1)
      WHILE NOT INSTAT:WEND:BOB$=INKEY$
      IF UCASE$(BOB$)="P" THEN CALL SAVETELA
      SCREEN 0:BLOAD "D:TELO"
      GOTO PLOT1

'*************************************************************************
'                        LISTAGEM INSTANTANEA
LISTIN:
      DEF SEG=&HB800
      BSAVE "D:TELO",0,4000

TOMA2:
      LOCATE 19,41:PRINT "INSTANTE:";:T$=FNPPLV$(4,-1)
      IF T$=CHR$(27) THEN VOLTA ELSE TT=VAL(T$)
      LOCATE 20,41:PRINT "PARAMETRO (U,V,N):";:FLG$=UCASE$(FNPPLV$(1,-1))
      IF FLG$<>"U" AND FLG$<>"V" AND FLG$<>"N" THEN TOMA2

      '..................... Le os Dados
      RREG=4
      FIELD #1,10 AS BRG$
      WHILE RREG<TREG
        IF INKEY$=CHR$(27) THEN VOLTA
        INCR RREG:GET #1,RREG:RG$=BRG$
        TEMPO=CVS(LEFT$(RG$,4)):NPG=CVI(MID$(RG$,5,2))
        IF  ABS(TEMPO-TT)<.001 THEN LISTA ELSE RREG=RREG+NPG
      WEND
      BEEP:LOCATE 23,41:PRINT "INTERVALO NAO EXISTE"
      DELAY 1
      GOTO VOLTA

LISTA:
      FOR RI=RREG+1 TO RREG + NPG
          GET #1,RI
          M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
          U(M,N)=CSNG(CVI(MID$(BRG$,3,2)))/100
          V(M,N)=CSNG(CVI(MID$(BRG$,5,2)))/100
          H(M,N)=CVS(RIGHT$(BRG$,4))
          IF INKEY$=CHR$(27) THEN VOLTA
      NEXT RI

      CABEC$=" ARQUIVO:"+ARQCAMPO$+"** SIMULACAO :"+TITSIMUL$

      IF FLG$="N" THEN
      FRASE$="NIVEL D'AGUA - Cotas em m  -  Instante:"+STR$(TT)+" h"
      IF FLG$="U" THEN
      FRASE$="VELOCIDADES EM X - (m/s)   -  Instante:"+STR$(TT)+" h"
```

```
        IF FLG$="V" THEN
        FRASE$="VELOCIDADES EM Y - (m/s)   -  Instante:"+STR$(TT)+" h"


        CALL HEADER(-1,CABEC$,ITAMPG)

         FOR NP=1 TO NMAX STEP 26

           CALL HEADER(0,CABEC$,ITAMPG)
           PRINT #20,""
           PRINT #20,TAB((ITAMPG-LEN(FRASE$))/2) FRASE$
           PRINT #20,""
           PRINT #20,CHR$(15)

           LIPRINT=NP+26-1:IF LIPRINT>NMAX THEN LIPRINT=NMAX
           PRINT #20,"¦YX¦";
           FOR JP=NP TO LIPRINT
               PRINT #20,USING "#####";JP;
           NEXT JP
           PRINT #20,"¦YX"
           PRINT #20,STRING$(137,45)
           FOR MP=MMAX TO 1 STEP -1
              PRINT #20,USING "¦##¦";MP;
              FOR JP=NP TO LIPRINT
                 IF INKEY$=CHR$(27) THEN VOLTA
                 IF FLG$="N" THEN PRINT #20,USING "##.##";H(MP,JP);
                 IF FLG$="U" THEN PRINT #20,USING "###.#";U(MP,JP);
                 IF FLG$="V" THEN PRINT #20,USING "###.#";V(MP,JP);
              NEXT JP
              PRINT #20,USING "¦##";MP
           NEXT MP
           PRINT #20,CHR$(18)
         NEXT NP
         CALL HEADER(-2,"",ITAMPG)
         GOTO VOLTA
'************************************************************************
'                      VELOCIGRAMAS/LMNIGRAMAS
VEL:
        DEF SEG=&HB800
        BSAVE "D:TELA",0,4000

TOMA3:
        LOCATE 19,41:PRINT "COO X1  :";:T$=FNPPLV$(2,-1)
        IF T$=CHR$(27) THEN VOLTA ELSE MP1=VAL(T$)
        LOCATE 20,41:PRINT "COO Y1  :";:T$=FNPPLV$(2,-1)
        IF T$=CHR$(27) THEN VOLTA ELSE NP1=VAL(T$)
        LOCATE 19,61:PRINT "COO X2  :";:T$=FNPPLV$(2,-1)
        IF T$=CHR$(13) THEN TEMPOS(0)=1:GOTO LED1
        IF T$=CHR$(27) THEN VOLTA ELSE MP2=VAL(T$)
        LOCATE 20,61:PRINT "COO Y2  :";:T$=FNPPLV$(2,-1)
        IF T$=CHR$(27) THEN VOLTA ELSE NP2=VAL(T$)
        TEMPOS(0)=2
LED1:
        SATGR=ATC*IOPS

        '..................... Le os Dados
        RREG=4:NDADOS=0:IPOSREG1=0:IPOSREG2=0
        FIELD #1,10 AS BRG$
        GET #1,5:RG$=BRG$
        TEMPO=CVS(LEFT$(RG$,4)):NPG=CVI(MID$(RG$,5,2))
        FOR RIP=6 TO 6+NPG
            GET #1,RIP
            M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
            IF M=MP1 AND N=NP1 THEN IPOSREG1=RIP-5:EXIT FOR
        NEXT RIP
        FOR RIP=6 TO 6+NPG
            GET #1,RIP
            M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
            IF M=MP2 AND N=NP2 THEN IPOSREG2=RIP-5:EXIT FOR
        NEXT RIP
        IF IPOSREG1=0 OR (TEMPOS(0)=2 AND IPOSREG2=0) THEN
             BEEP:LOCATE 23,41:PRINT "PONTO NAO EXISTE"
             DELAY 1
             GOTO VOLTA
        END IF

        WHILE RREG<TREG
```

```
        INCR RREG
        INCR NDADOS
            GET #1,RREG+IPOSREG1
              IF INKEY$=CHR$(27) THEN TOMA3
              IF IOPT=3 THEN VAZOES(NDADOS)=CSNG(CVI(MID$(BRG$,3,2)))/100
              IF IOPT=4 THEN VAZOES(NDADOS)=CSNG(CVI(MID$(BRG$,5,2)))/100
              IF IOPT=5 THEN VAZOES(NDADOS)=CVS(MID$(BRG$,7,4))
              IF TEMPOS(0)=2  THEN
                 GET #1,RREG+IPOSREG2
                 IF INKEY$=CHR$(27) THEN TOMA3
                 IF IOPT=3 THEN TEMPOS(NDADOS)=CSNG(CVI(MID$(BRG$,3,2)))/100
                 IF IOPT=4 THEN TEMPOS(NDADOS)=CSNG(CVI(MID$(BRG$,5,2)))/100
                 IF IOPT=5 THEN TEMPOS(NDADOS)=CVS(MID$(BRG$,7,4))
              END IF
         RREG=RREG+NPG
       WEND
DESENHA:
       LOCATE 21,41:PRINT "ESCmax=";:Y$=FNPPLV$(4,-1)
       IF Y$=CHR$(27) THEN TOMA3 ELSE YMAX=VAL(Y$)
       LOCATE 22,41:PRINT "ESCmin=";:YMIN=VAL(FNPPLV$(4,-1))
       DEF SEG=&HB800
       BSAVE "d:TEL1",0,4000
       IF YMIN>YMAX THEN DESENHA
       LOCON1$=STR$(MP1)+","+STR$(NP1)
       LOCON2$=STR$(MP2)+","+STR$(NP2)
       TIT$=ARQ$+" Ponto:"+STR$(MP1)+","+STR$(NP1)+"/"+STR$(MP2)+","+STR$(NP2)
       CALL GRAFICO(IOPT,TIT$,NDADOS)
       BLOAD "D:TEL1"
       GOTO DESENHA
'*************************************************************************
'                VELOCIDADES - MODULO E DIRECAO
MODIR:
       DEF SEG=&HB800
       BSAVE "D:TEL0",0,4000

TOMA4:
       LOCATE 19,41:PRINT "COO X   :";:T$=FNPPLV$(2,-1)
       IF T$=CHR$(27) THEN VOLTA ELSE MP=VAL(T$)
       LOCATE 20,41:PRINT "COO Y   :";:T$=FNPPLV$(2,-1)
       IF T$=CHR$(27) THEN VOLTA ELSE NP=VAL(T$)
       SATGR=ATC*IOPS

       '..................... Le os Dados
       RREG=4:NDADOS=0:IPOSREG1=0
       FIELD #1,10 AS BRG$
       GET #1,5:RG$=BRG$
       TEMPO=CVS(LEFT$(RG$,4)):NPG=CVI(MID$(RG$,5,2))
       FOR RIP=6 TO 6+NPG
           GET #1,RIP
           M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
           IF M=MP AND N=NP THEN IPOSREG1=RIP-5:EXIT FOR
       NEXT RIP
       IF IPOSREG1=0 THEN
            BEEP:LOCATE 23,41:PRINT "PONTO NAO EXISTE"
            DELAY 1
            GOTO VOLTA
       END IF

       WHILE RREG<TREG
         INCR RREG
         INCR NDADOS
            GET #1,RREG+IPOSREG1
              IF INKEY$=CHR$(27) THEN TOMA4
              VA=CSNG(CVI(MID$(BRG$,3,2)))/100
              TE=CSNG(CVI(MID$(BRG$,5,2)))/100
              VAZOES(NDADOS)=SQR(VA^2+TE^2)
              IF VA=0 THEN VA=.1E-30
              IF TE=0 THEN TE=.1E-30
              ANGU=ATN(TE/VA)
              IF VA<0 AND TE>0 THEN ANGU=ANGU+PI
              IF VA<0 AND TE<0 THEN ANGU=ANGU+PI
              ANGU=ANGU*180/PI+90
              TEMPOS(NDADOS)=ANGU
         RREG=RREG+NPG
       WEND
DESENHA1:
       LOCATE 21,41:PRINT "ESCmax=";:Y$=FNPPLV$(4,-1)
```

```
      IF Y$=CHR$(27) THEN TOMA4 ELSE YMAX=VAL(Y$)
      LOCATE 22,41:PRINT "ESCmin=";:YMIN=VAL(FNPPLV$(4,-1))
      BSAVE "d:TEL1",0,4000
      IF YMIN>YMAX THEN DESENHA1
      TIT$=ARQ$+" Ponto:"+STR$(M)+","+STR$(N)
      CALL GRAFICO(IOPT,TIT$,NDADOS)
      BLOAD "D:TEL1"
      GOTO DESENHA1

'*************************************************************************
'              HIDROGRAMAS NUMA SECAO DADA
HIDRO:
      DEF SEG=&HB800
      BSAVE "D:TEL0",0,4000

TOMA5:
      LOCATE 20,41:PRINT "SECAO 1 :";:T$=FNPPLV$(22,-1)
      IF T$=CHR$(27) THEN VOLTA ELSE LOCON1$=T$
      LOCATE 21,41:PRINT "SECAO 2 :";:T$=FNPPLV$(22,-1)
      IF T$="" THEN TEMPOS(0)=1 ELSE TEMPOS(0)=2
      IF T$=CHR$(27) THEN VOLTA ELSE LOCON2$=T$
      SATGR=ATC*IOPS

         MC1=0:NC1=0:NPA1=0
         FOR L=1 TO LEN(LOCON1$)
            AUX$=UCASE$(MID$(LOCON1$,L,1))
            IF AUX$="X" THEN MC1=VAL(MID$(LOCON1$,L+1,2))
            IF AUX$="Y" THEN NC1=VAL(MID$(LOCON1$,L+1,2))
            IF AUX$="I" THEN INC1=VAL(MID$(LOCON1$,L+1,2))
            IF AUX$="F" THEN FIC1=VAL(MID$(LOCON1$,L+1,2))
            IF AUX$="D" THEN NPA1=VAL(MID$(LOCON1$,L+1,2))
         NEXT L

         IF TEMPOS(0)<>2 THEN SALT1

         MC2=0:NC2=0:NPA2=0
         FOR L=1 TO LEN(LOCON2$)
            AUX$=UCASE$(MID$(LOCON2$,L,1))
            IF AUX$="X" THEN MC2=VAL(MID$(LOCON2$,L+1,2))
            IF AUX$="Y" THEN NC2=VAL(MID$(LOCON2$,L+1,2))
            IF AUX$="I" THEN INC2=VAL(MID$(LOCON2$,L+1,2))
            IF AUX$="F" THEN FIC2=VAL(MID$(LOCON2$,L+1,2))
            IF AUX$="D" THEN NPA2=VAL(MID$(LOCON2$,L+1,2))
         NEXT L
      '..................... Le os Dados
SALT1:
      RREG=4:NDADOS=0
      FIELD #1,10 AS BRG$

      WHILE RREG<TREG
        INCR RREG:GET #1,RREG:RG$=BRG$
        TEMPO=CVS(LEFT$(RG$,4)):NPG=CVI(MID$(RG$,5,2))
        FOR RIP=RREG+1 TO RREG+NPG
           GET #1,RIP
           M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
           U(M,N)=CSNG(CVI(MID$(BRG$,3,2)))/100
           V(M,N)=CSNG(CVI(MID$(BRG$,5,2)))/100
           H(M,N)=CVS(RIGHT$(BRG$,4))
           IF INKEY$=CHR$(27) THEN TOMA5
        NEXT RIP

        INCR NDADOS
        VAZOES(NDADOS)=0
        IF MC1>0 THEN
           FOR NC1=INC1 TO FIC1 STEP SGN(FIC1-INC1)
                VAZOES(NDADOS)=VAZOES(NDADOS)+U(MC1,NC1)*AY*(H(MC1,NC1)-Z(MC1,NC1))
           NEXT NC1
           NC1=0
        ELSE
           ND1=NC1
           FOR MC1=INC1 TO FIC1 STEP SGN(FIC1-INC1)
                VAZOES(NDADOS)=VAZOES(NDADOS)+SQR(AX^2+(NPA1*AY)^2)*
                    (H(MC1,ND1)-Z(MC1,ND1))*(-V(MC1,ND1)*COS(ATN(NPA1))+_
                     U(MC1,ND1)*ABS(SIN(ATN(NPA1))))
                ND1=ND1+NPA1
           NEXT MC1
           MC1=0
```

```
        END IF

        IF TEMPOS(0)<>2 THEN SALT2
        TEMPOS(NDADOS)=0
        IF MC2>0 THEN
           FOR NC2=INC2 TO FIC2 STEP SGN(FIC2-INC2)
                TEMPOS(NDADOS)=TEMPOS(NDADOS)+U(MC2,NC2)*AY*(H(MC2,NC2)-Z(MC2,NC2))
           NEXT NC2
           NC2=0
        ELSE
           ND2=NC2
           FOR MC2=INC2 TO FIC2 STEP SGN(FIC2-INC2)
                TEMPOS(NDADOS)=TEMPOS(NDADOS)+SQR(AX^2+(NPA2*AY)^2)*
                    (H(MC2,ND2)-Z(MC2,ND2))*(-V(MC2,ND2)*COS(ATN(NPA2))+_
                     U(MC2,ND2)*ABS(SIN(ATN(NPA2))))
                ND2=ND2+NPA2
           NEXT MC2
           MC2=0
        END IF
SALT2:
        RREG=RREG+NPG
      WEND


DESENHA3:
      LOCATE 22,41:PRINT "ESCmax=";:Y$=FNPPLV$(8,-1)
      IF Y$=CHR$(27) THEN TOMA5 ELSE YMAX=VAL(Y$)
      LOCATE 23,41:PRINT "ESCmin=";:YMIN=VAL(FNPPLV$(8,-1))
      BSAVE "d:TEL1",0,4000
      IF YMIN>YMAX THEN DESENHA3
      TIT$=ARQ$+" Sec:"+LOCON1$+"/"+LOCON2$
      CALL GRAFICO(IOPT,TIT$,NDADOS)
      BLOAD "D:TEL1"
      GOTO DESENHA3

'*************************************************************************
'                    MAPA DE CURVAS DE NIVEL
'          PLOTA VALORES DO NIVEL D'AGUA DA FORMA INDICADA
CUNI:
      DEF SEG=&HB800
      BSAVE "D:TELO",0,4000
TOMA8:
      LOCATE 19,41:PRINT "INSTANTE:";:T$=FNPPLV$(4,-1)
      IF T$=CHR$(27) THEN VOLTA ELSE TT=VAL(T$)

      '..................... Le os Dados
      RREG=4
      FIELD #1,10 AS BRG$
      WHILE RREG<TREG
        IF INKEY$=CHR$(27) THEN VOLTA
        INCR RREG:GET #1,RREG:RG$=BRG$
        TEMPO=CVS(LEFT$(RG$,4)):NPG=CVI(MID$(RG$,5,2))
        IF  ABS(TEMPO-TT)<.001 THEN PLOT8 ELSE RREG=RREG+NPG
      WEND
      BEEP:LOCATE 23,41:PRINT "INTERVALO NAO EXISTE"
      DELAY 1
      GOTO VOLTA
PLOT8:
      FOR RI=RREG+1 TO RREG + NPG
          GET #1,RI
          M=ASC(LEFT$(BRG$,1)):N=ASC(MID$(BRG$,2,1))
          H(M,N)=CVS(RIGHT$(BRG$,4))
          IF INKEY$=CHR$(27) THEN VOLTA
      NEXT RI
PLOTE8:
      LOCATE 20,41:PRINT "EQUIDIST:";:ES$=FNPPLV$(4,-1)
      IF ES$=CHR$(27) THEN TOMA8 ELSE ESCU=VAL(ES$)
      IF ESCU=0  THEN PLOTE8
      CALL PLOT(ESCU,ESCV,1,2)
      WHILE NOT INSTAT:WEND:BOB$=INKEY$
      IF UCASE$(BOB$)="P" THEN CALL SAVETELA
      SCREEN 0:BLOAD "D:TELO"
      GOTO PLOTE8

'.....................................................................
$INCLUDE "MDBD2701.BAS"  ' LEITURA DO CAMPO
$INCLUDE "MDBD2601.BAS"  ' SCANNING
```

```
'.....................................................................
VOLTA:
      CLOSE #20
      SCREEN 0
      BLOAD "D:TEL0"
      TEMPOS(0)=0
      GOTO MENU
'.....................................................................
DIRETORIO:
       DEF SEG=&HB800
       BSAVE "D:TEL0",0,4000
       LOCATE 7,3:PRINT STRING$(74,"■")
       LOCATE 8,3:FILES DRIVESPOOL$
       WHILE NOT INSTAT:WEND:BOB$=INKEY$
       BLOAD "D:TEL0"
       GOTO TEL0
'.....................................................................
'.....................................................................
ESCAPE:
     IF LINK$="TEL0" THEN STOP
     IF LINK$="TEL1" THEN
          CLOSE
          LINK$="TEL0"
          BLOAD "D:TEL0"
          GOTO TEL0
     END IF

'.....................................................................
ERRORDEALER:
       BEEP
       PRINT "ERROR:"ERR"  NO ENDERECO:"ERADR
       STOP
'.....................................................................
KEY10:

       CLOSE
       STOP
'.....................................................................
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'       MODELO HIDRODINAMICO BIDIMENSIONAL - SUB GRAFICO
'                       MDBD1801
'
'CRIADO     EM:
'ATUALIZADA EM: 28/08/1989        POR:RODOLFO
'MODULO:MDBD1801.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX


SUB GRAFICO(IOP,TIT$,NDADOS)

   SHARED CHAR$()
   SHARED VAZOES(),TEMPOS()

   SHARED DIA$,DRIVEMOD$,DRIVESPOOL$,ARQCAMPO$,LOCON1$,LOCON2$
   SHARED SATGR,YMAX,YMIN
   LOCAL I,CREF,PG,PY10,IA,IB,A$,X,XX.CLIP,SIMB$,SIMB1$

    SCREEN 2

       CALL DRAWSTRING(58+(548-12*LEN(TIT$))/2,5,2,TIT$)

       LINE (60,14)-(600,174),,B
       SIMB$="L2 R4" "BR2 U1 BL1 L2 BL1 D2 BR1 R2 BR1 U1 BL2"
       SIMB1$="U2 D4 U2 L2 R4 L2"

       IF IOP=3 OR IOP=4 OR IOP=6 OR IOP=7 THEN CREF=0 ELSE CREF=INT(YMIN)

       PG=YMAX-YMIN
       IF PG<=0 THEN PG=.1

       IF YMAX-CREF>0 THEN
          PY10=INT(LOG10(ABS(YMAX-CREF)))
       ELSE
          IF YMIN-CREF<>0 THEN PY10=INT(LOG10(ABS(YMIN-CREF))) ELSE PY10=0
       END IF

       FOR I=0 TO 10
          X=I
          X=YMAX-CREF-X*PG/10
          IA =FIX((X/(10^PY10))*100+.5*SGN(X))
          A$=STR$(IA/100)
          CALL DRAWSTRING(30+(4-LEN(A$))*6,171-((X-YMIN+CREF)*160/PG),1,A$)
          LINE (60,174-((X-YMIN+CREF)*160/PG))-(65,174-((X-YMIN+CREF)*160/PG))
       NEXT I

       IF PY10<>0 THEN
          CALL DRAWSTRING(5,8,1,"x10")
          CALL DRAWSTRING(19,5,1,RIGHT$(STR$(PY10),2))
       END IF
       IF CREF<>0 THEN CALL DRAWSTRING(1,163,1,STR$(CREF)+".00+")

       CALL DRAWSTRING(80,18,1,"ARQ:"+ARQCAMPO$)

       XMIN=0:XMAX=SATGR*(NDADOS-1)
       XG=XMAX-XMIN
       IF XG=0 THEN XG=.1
       FOR I=0 TO 12
          X=I:X=XMIN+X*XG/12
          XX=X/3600:IA=INT(XX):XX=IA
          XX=XX*3600:IB=X-XX
          A$=STR$(INT(IB/60))
          IF LEN(A$)>2 THEN A$=RIGHT$(A$,2) ELSE A$="0"+RIGHT$(A$,1)
          A$=STR$(IA)+":"+A$
          XX=44+FIX(X-XMIN)*536/XG
          CALL DRAWSTRING(XX,177,1,A$)
       NEXT I
       FOR I=0 TO 24
          X=I:X=XMIN+X*XG/24
          XX=60+(X-XMIN)*540/XG
          LINE (XX,174)-(XX,170)
       NEXT I
       LOCATE 24,38:PRINT "TEMPO (h)";
       CLIP=174- ( ( VAZOES(1)-YMIN ) *160/PG )
       IF CLIP<14 THEN CLIP=14
```

```
IF CLIP>174 THEN CLIP=174
PSET (60,CLIP)
'DRAW SIMB$
FOR I=1 TO NDADOS
   X=(I-1)*SATGR
   CLIP=174- ( ( VAZOES(I)-YMIN ) *160/PG )
   IF CLIP<14 THEN CLIP=14
   IF CLIP>174 THEN CLIP=174
   LINE-(60+(X-XMIN)/XG*540,CLIP )
   'DRAW SIMB$
NEXT I
IF TEMPOS(0)=2 THEN
  PSET (500,18):DRAW SIMB$ :CALL DRAWSTRING(508,18,1,LOCON1$)
  PSET (500,25):DRAW SIMB1$:CALL DRAWSTRING(508,25,1,LOCON2$)
  CLIP=174- ( ( TEMPOS(1)-YMIN ) *160/PG )
  IF CLIP<14 THEN CLIP=14
  IF CLIP>174 THEN CLIP=174
  PSET (60,CLIP)
  DRAW SIMB1$
  FOR I=1 TO NDADOS
     X=(I-1)*SATGR
     CLIP=174- ( ( TEMPOS(I)-YMIN ) *160/PG )
     IF CLIP<14 THEN CLIP=14
     IF CLIP>174 THEN CLIP=174
     LINE-(60+(X-XMIN)/XG*540,CLIP )
     DRAW SIMB1$
  NEXT I
END IF
IF IOP=6 THEN
    PSET (500,18):DRAW SIMB$ :CALL DRAWSTRING(508,18,1,"Vel")
    PSET (500,25):DRAW SIMB1$:CALL DRAWSTRING(508,25,1,"Ang")
    FOR I=60 TO 600 STEP 2:PSET(I,94):NEXT I
    LINE (596,54)-(600,54):LINE (596,134)-(600,134)
    CALL DRAWSTRING(602,15,1,"360")
    CALL DRAWSTRING(602,52,1,"270")
    CALL DRAWSTRING(602,93,1,"180")
    CALL DRAWSTRING(602,133,1,"90")
    CALL DRAWSTRING(602,171,1,"0")
    CLIP= 174 - (  TEMPOS(1)  *160/360 )
    IF CLIP<14 THEN CLIP=14
    IF CLIP>174 THEN CLIP=174
    PSET (60,CLIP)
    FOR I=1 TO NDADOS
       X=(I-1)*SATGR
       CLIP= 174 - (  TEMPOS(I) *160/360 )
       IF CLIP<14 THEN CLIP=14
       IF CLIP>174 THEN CLIP=174
       LINE-(60+(X-XMIN)/XG*540,CLIP )
       DRAW SIMB1$
    NEXT I
END IF
IF IOP=3  THEN P$="VELOCIDADE X"
IF IOP=4  THEN P$="VELOCIDADE Y"
IF IOP=5  THEN P$="NIVEL D'AGUA"
IF IOP=6  THEN P$="MODULO DE  V"
IF IOP=7  THEN P$="V A Z A O"
LL=INT((24-LEN(P$))/2)
FOR I=1 TO LEN(P$)
   C$=MID$(P$,I,1)
   LOCATE LL+I,2
   PRINT C$;
NEXT I
IF IOP=6  THEN
   P$="D I R E C A O "
   LL=INT((24-LEN(P$))/2)
   FOR I=1 TO LEN(P$)
      C$=MID$(P$,I,1)
      LOCATE LL+I,79
      PRINT C$;
   NEXT I
END IF
IF IOP=3 OR IOP=4 OR IOP=6 OR IOP=7 THEN
   CALL DRAWSTRING(9,156,1,"m")
   CALL DRAWSTRING(9,161,1,"-")
   CALL DRAWSTRING(9,166,1,"s")
ELSE
   CALL DRAWSTRING(9,150,1,"m")
```

```
        END IF
        IF IOP=7 THEN CALL DRAWSTRING(12,153,1,"3")

     CALL DRAWSTRING(60,190,1,"M D B D")
     CALL DRAWSTRING(60,196,1,DIA$)
      CALL DRAWSTRING(492,196,1,"")

3310 WHILE NOT INSTAT:WEND:P$=UCASE$(INKEY$)
     IF P$="P" OR P$="S" THEN
        CALL SAVETELA
        GOTO 3310
     END IF
     IF P$="L" THEN
        CALL HEADER(-1,TIT$,80)
        CALL HEADER(0,"ARQUIVO: "+ARQRED$+" - "+TIT$,80)
        PRINT #20,""
        PRINT #20,TAB(20) STRING$(19,45)
        PRINT #20,TAB(20) "¦ HORA  ¦  VALOR   ¦"
        PRINT #20,TAB(20) STRING$(19,45)
        FOR I=1 TO NDADOS
           X=(I-1)*SATGR
           XX=X/3600:IA=INT(XX):XX=IA
           XX=XX*3600:IB=X-XX
           A$=STR$(IB/60)
           IF LEN(A$)=3 THEN A$=RIGHT$(A$,2) ELSE A$="0"+RIGHT$(A$,1)
           A$=STR$(IA)+":"+A$
           CALL HEADER(1,"ARQUIVO: "+ARQRED$+" - "+TIT$,80)
           PRINT #20,TAB(20) "¦ ";A$;TAB(28);"¦";
           PRINT #20, USING FNORD$(VAZOES(I),5);VAZOES(I)
        NEXT I
        CALL HEADER(3,"ARQUIVO: "+ARQRED$+" - "+TIT$,80)
        PRINT #20,TAB(20) STRING$(20,45)
        PRINT #20,""
        CALL HEADER (-2,"",80)
        GOTO 3310
     END IF
     SCREEN 0,0,0,0

END SUB
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'************************ SUBROTINA DESENHO DE QUADRO ************************
'
'CRIADO EM:     01-02-88     POR: FRANCISCO
'ATUALIZADO EM: 02-02-88     POR: FRANCISCO
'
'MODULO: MDBD2301.BAS
'******************************************************************************
'
'       DICIONARIO DE PARAMETROS
'
'       LIN         - NUMERO DA LINHA
'       COL         - NUMERO DA COLUNA
'       TAM         - TAMANHO DA PALAVRA
'       CORF         - COR DO FUNDO
'
'------------------------------------------------------------------------------

SUB BOX(LIN,COL,TAM,CORF) STATIC
   COLOR 7,CORF
   LOCATE LIN-1,COL-2
   PRINT CHR$(201);
   PRINT STRING$(TAM+2,205);
   PRINT CHR$(187);
   LOCATE LIN,COL-2
   PRINT CHR$(186);
   PRINT STRING$(TAM+2,32);
   PRINT CHR$(186);
   LOCATE LIN+1,COL-2
   PRINT CHR$(200);
   PRINT STRING$(TAM+2,205);
   PRINT CHR$(188);
   LOCATE LIN,COL
END SUB
```

```
'XxxxxxxxxXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXxxxxxxxxxxxXXXXXXXXXXXX
'
'          PROGRAMA DE UTILIDADES SISTEMA MDBD
'
'
'CRIADO EM:11-03-1988              POR: RODOLFO
'ATUALIZADO EM:24/08/89            MDBD2401.BAS
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
'
' ------------------------------------------------------------------
     CLEAR

$STACK 32760

     ON ERROR GOTO 2497

     DEFINT I-N

'------------------------------------------------------------------
'     OPEN "I",#1,"D:COMMON.MUD"
'        INPUT #1,OPER$,OPERNIV$,DRIVE$,DRIVEMOD$,DRIVESPOOL$,LINK$,DIA$
'        INPUT #1,ITAMPG,ITIPGRAF
'     CLOSE #1
'------------------------------------------------------------------
DRIVEMOD$="C:\MDBD\"
     DIM DYNAMIC PALMAT$(30)
     DIM DYNAMIC ITEM$(10)

' --------------------------------------------------------------------
$INCLUDE "MDBD0101.BAS" 'FNPPLV
$INCLUDE "MDBD0201.BAS" 'PAGINA
$INCLUDE "MDBD1501.BAS" 'MENU
'$INCLUDE "MDBD2201.BAS" 'AJUDA
$INCLUDE "MDBD2301.BAS" 'BOX
'$INCLUDE "MDBD2501.BAS" 'CADASTRO
'------------------------------------------------------------------
'------------------------------------------------------------------

DEF FNSEMBRANCO$(A$)
    AUX$=""
    FOR I=1 TO LEN(A$)
       IF MID$(A$,I,1)<>" " THEN AUX$=AUX$+MID$(A$,I,1)
    NEXT I
    FNSEMBRANCO$=AUX$
END DEF
'------------------------------------------------------------------

     OPEN "R",#1,DRIVEMOD$+"MDBD.CNF",55

     DEF SEG=&HB800
     BSAVE "D:TELL",0,4000
2401 ON KEY (10) GOSUB 2498:KEY (10) ON

     ITEM$(1)= "PARAMETROS DO SISTEMA     "
     ITEM$(2)= "PARAMETROS DA IMPRESSAO   "
     ITEM$(3)= "PARAMETROS DE TELA        "
     ITEM$(4)= "PARAMETROS DA SIMULACAO   "
     ITEM$(5)= "CADASTRAMENTO DE USUARIOS"
     ITEM$(6)= "SHELL DOS                 "
     ITEM$(7)= "AJUDA                     "
2402 IOPT=FNMENU(7,8,20,30,"     M D B D - UTILIDADES     ")
     DEF SEG=&HB800:BSAVE "D:TELO",0,4000
     ON IOPT GOTO 2410,2420,2430,2470,2440,2450,2460
     GOTO 2402

2410 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'             PARAMETROS DO SISTEMA
      ON KEY (10) GOSUB 2497:KEY (10) ON
      FIELD #1,15 AS PARM1$,15 AS PARM2$,15 AS PARM3$,10 AS PARM4$
      GET #1,1
      DRIVE$=FNSEMBRANCO$(PARM1$):DRIVEMOD$=FNSEMBRANCO$(PARM2$)
      DRIVESPOOL$=FNSEMBRANCO$(PARM3$)
     ITEM$(1)= "    DRIVE/PATH  DADOS     "
     ITEM$(2)= "DRIVE/PATH DEFAULT MODULOS"
     ITEM$(3)= "DRIVE/PATH SPOOL IMPRESSAO"
     ITEM$(4)= "SALVAR  AS   OPCOES       "
2415 IOPT=FNMENU(4,7,45,30,"     PARAMETROS DO SISTEMA     ")
```

```
    ON IOPT GOTO 2411,2412,2413,2414
'.....................................................................
2411 LOCATE 19,45:PRINT"DRIVE DADOS DE REDE: ";DRIVE$
     CALL BOX(21,50,15,0):K$=FNPPLV$(15,-1)
     K$=UCASE$(K$)
     IF LEN(K$)<>0 THEN
        IF RIGHT$(K$,1)<>"\" THEN K$=K$+"\"
     DRIVE$=FNSEMBRANCO$(K$)
     END IF
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2415
'.....................................................................
2412 LOCATE 19,45:PRINT"DRIVE DEFAULT MODULOS: ";DRIVEMOD$
     CALL BOX(21,50,15,0):K$=FNPPLV$(15,-1)
     K$=UCASE$(K$)
     IF LEN(K$)<>0 THEN
        IF RIGHT$(K$,1)<>"\" THEN K$=K$+"\"
     DRIVEMOD$=FNSEMBRANCO$(K$)
     END IF
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2415
'.....................................................................
2413 LOCATE 19,45:PRINT"DRIVE SPOOL IMPRESSAO: ";DRIVESPOOL$
     CALL BOX(21,50,15,0):K$=FNPPLV$(15,-1)
     K$=UCASE$(K$)
     IF LEN(K$)<>0 THEN
        IF RIGHT$(K$,1)<>"\" THEN K$=K$+"\"
     DRIVESPOOL$=FNSEMBRANCO(K$)
     END IF
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2415
'.....................................................................
2414 LSET PARM1$=DRIVE$:LSET PARM2$=DRIVEMOD$:LSET PARM3$=DRIVESPOOL$
     PUT #1,1
     GOTO 2415
'.....................................................................
2420 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'              PARAMETROS DE IMPRESSAO
      ON KEY (10) GOSUB 2497:KEY (10) ON
      FIELD #1,2 AS PARM1$,2 AS PARM2$,2 AS PARM3$,2 AS PARM4$,47 AS BOB$
      GET #1,2
      ITAMPG=CVI(PARM1$):ICARACLIN=CVI(PARM2$)
      ICARACPOL=CVI(PARM3$):ITIPGRAF=CVI(PARM4$)
      ITEM$(1)= "LARGURA DO PAPEL      "
      ITEM$(2)= "CARACTERES POR LINHA "
      ITEM$(3)= "CARACTERES POR POLEG."
      ITEM$(4)= "TIPO DE GRAFICO       "
      ITEM$(5)= "SALVAR AS OPCOES      "
2426  IOPT=FNMENU(5,7,45,34,"     PARAMETROS DE IMPRESSAO     ")
      K$=""
      ON IOPT GOTO 2421,2422,2423,2424,2425
'.....................................................................
2421 LOCATE 19,45:PRINT"LARGURA DA PAGINA   : ";ITAMPG
     CALL BOX(21,50,3,0):K$=FNPPLV$(3,-1):IF LEN(K$)<>0 THEN ITAMPG=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2426
'.....................................................................
2422 LOCATE 19,45:PRINT"CARACTERES POR LINHA    : ";ICARACLIN
     CALL BOX(21,50,3,0):K$=FNPPLV$(3,-1):IF LEN(K$)<>0 THEN ICARACLIN=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2426
'.....................................................................
2423 LOCATE 19,45:PRINT"CARACTERES POR POLEG.:";ICARACPOL
     CALL BOX(21,50,1,0):K$=FNPPLV$(1,-1):IF LEN(K$)<>0 THEN ICARACPOL=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2426
'.....................................................................
2424 LOCATE 19,45:PRINT"TIPO DE GRAFICO (0/1): ";ITIPGRAF
     CALL BOX(21,50,1,0):K$=FNPPLV$(1,-1):IF LEN(K$)<>0 THEN ITIPGRAF=VAL(K$)
     IF ITIPGRAF<>0 AND ITIPGRAF<>1 THEN 2421
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2426

'.....................................................................
2425 LSET PARM1$=MKI$(ITAMPG):LSET PARM2$=MKI$(ICARACLIN)
     LSET PARM3$=MKI$(ICARACPOL):LSET PARM4$=MKI$(ITIPGRAF)
     PUT #1,2
```

```
    GOTO 2426
'.....................................................................
2430 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     ON KEY (10) GOSUB 2497:KEY (10) ON
     FOR I=5 TO 22:LOCATE I,40:PRINT SPC(39):NEXT I
     LOCATE 12,45:PRINT "OPCAO NAO DISPONIVEL"
     LOCATE 13,45:PRINT "MONITOR MONOCROMATICO"
     DELAY 3
     GOTO 2497
2440 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     ON KEY(10) GOSUB 2497:KEY(10)ON
     LINK0$=LINK$
     LINK$="CADAS"
'     CALL CADASTRO(OPERNIV$)
     GOTO 2497
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
2450 CLS
     SHELL
     GOTO 2497
2460 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     KEY(10) OFF
'     CALL AJUDA("UTIL")
     GOTO 2401
2470 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'            PARAMETROS DA SIMULACAO
     ON KEY (10) GOSUB 2497:KEY (10) ON
     FIELD #1,2 AS PARM1$,2 AS PARM2$,2 AS PARM3$,2 AS PARM4$,47 AS BOB$
     GET #1,3
     ID1=CVI(PARM1$):ID2=CVI(PARM2$)
     ID3=CVI(PARM3$):ID4=CVI(PARM4$)
     ITEM$(1)= "Nº MAXIMO DE TRIBUTARIOS          "
     ITEM$(2)= "Nº MAXIMO DE SECOES/CANAL         "
     ITEM$(3)= "Nº MAXIMO DE PONTOS/COND.CONTORNO"
     ITEM$(4)= "Nº PTOS TABELA DE CARACTERISTICAS"
     ITEM$(5)= "SALVAR AS OPCOES                  "
2476 IOPT=FNMENU(5,7,45,34,"     PARAMETROS DA SIMULACAO     ")
     K$=""
     ON IOPT GOTO 2471,2472,2473,2474,2475
'.....................................................................
2471 LOCATE 19,45:PRINT"Nº MAXIMO DE TRIBUTARIOS:";ID1;
     CALL BOX(21,50,3,0):K$=FNPPLV$(3,-1):IF LEN(K$)<>0 THEN ID1=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2476
'.....................................................................
2472 LOCATE 19,45:PRINT"Nº MAXIMO DE SECOES/CANAL:";ID2;
     CALL BOX(21,50,3,0):K$=FNPPLV$(3,-1):IF LEN(K$)<>0 THEN ID2=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2476
'.....................................................................
2473 LOCATE 19,45:PRINT"Nº MAX DE PTOS/COND.CONT.:";ID3;
     CALL BOX(21,50,2,0):K$=FNPPLV$(2,-1):IF LEN(K$)<>0 THEN ID3=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2476
'.....................................................................
2474 LOCATE 19,45:PRINT"Nº PTOS TABELA DE CARACT.:";ID4;
     CALL BOX(21,50,2,0):K$=FNPPLV$(2,-1):IF LEN(K$)<>0 THEN ID4=VAL(K$)
     FOR I=19 TO 22:LOCATE I,43:PRINT SPC(39):NEXT I
     GOTO 2476

'.....................................................................
2475 LSET PARM1$=MKI$(ID1):LSET PARM2$=MKI$(ID2)
     LSET PARM3$=MKI$(ID3):LSET PARM4$=MKI$(ID4)
     PUT #1,3
     GOTO 2476
'.....................................................................


2497 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     KEY(10) OFF
     CLOSE #13
     COLOR 7,0
     DEF SEG=&HB800
     IF LINK$="CADAS" THEN BLOAD "D:TELU":LINK$=LINK0$:GOTO 2401
     BLOAD "D:TEL0"
     GOTO 2401
```

```
2498 'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     KEY(10) OFF
     CLOSE
     LINK$="UTIL"
'-------------------------------------------------------------------------
      OPEN "O",#1,"D:COMMON.MUD"
         WRITE #1,OPER$,OPERNIV$,DRIVE$,DRIVEMOD$,DRIVESPOOL$,LINK$,DIA$
         WRITE #1,ITAMPG,ITIPGRAF
      CLOSE #1
'-------------------------------------------------------------------------
     CLEAR
'-------------------------------------------------------------------------
'     OPEN "I",#1,"D:COMMON.MUD"
'        INPUT #1,OPER$,OPERNIV$,DRIVE$,DRIVEMOD$,DRIVESPOOL$,LINK$,DIA$
'        INPUT #1,ITAMPG,ITIPGRAF
'     CLOSE #1
'-------------------------------------------------------------------------

'     CHAIN DRIVEMOD$+"HMUD0601.SBR"
     END
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'
'           ROTINA DE BUSCA DOS PONTOS COM ESCOAMENTO
'
'MODULO: MDBD2601.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX


'.................SCANNING DOS DADOS DE CAMPO.........................
SCANNING:
        '.......... SCANNING - fixo M varro os N's
        MSEC=0
        FOR M=MMIN TO MMAX

           FLGI=0
           FOR N=NMIN TO NMAX
              IF FLGI=0  THEN
                IF CO$(M,N)="T" THEN
                   FLGI=1
                   NIN=N
                   GOTO NEXTN
                END IF
                GOTO NEXTN
              END IF

              IF FLGI=1  THEN
                IF CO$(M,N)="T" AND CO$(M,N+1)<>"T" THEN
                   FLGI=0
                   INCR MSEC
                   MSEC$(MSEC)=CHR$(M)+CHR$(NIN)+CHR$(N)
                   GOTO NEXTN
                END IF
              END IF
NEXTN:
           NEXT N

        NEXT M
        '.......... SCANNING - fixo N varro os M's
        NSEC=0
        FOR N=NMIN TO NMAX

           FLGI=0
           FOR M=MMIN TO MMAX

              IF FLGI=0  THEN
                IF CO$(M,N)="T" THEN
                   FLGI=1
                   MIN=M
                   GOTO NEXTM
                END IF
                GOTO NEXTM
              END IF

              IF FLGI=1  THEN
                IF CO$(M,N)="T" AND CO$(M+1,N)<>"T"  THEN
                   FLGI=0
                   INCR NSEC
                   NSEC$(NSEC)=CHR$(N)+CHR$(MIN)+CHR$(M)
                   GOTO NEXTM
                END IF
              END IF
NEXTM:
           NEXT M

        NEXT N

        RETURN

'.............................................................
```

```
'.................SCANNING DOS DADOS DE CAMPO.........................
SCANNING:
open "o",#4,"d:mostra"
        '......... SCANNING - fixo M varro os N's
        MSEC=0
        FOR M=1 TO MMAX

           FLGI=0
           FOR N=1 TO NMAX
              IF FLGI=0  THEN
                IF CO$(M,N)="T" THEN
                   FLGI=1
                   IF CO$(M,N-1)<>"H" AND CO$(M,N-1)<>"U" AND CO$(M,N-1)<>"V" _
                      THEN NIN=N ELSE NIN=N-1
                   GOTO NEXTN
                END IF
                GOTO NEXTN
              END IF

              IF FLGI=1  THEN
                IF CO$(M,N)="H" OR CO$(M,N)="U" OR CO$(M,N)="V" THEN
                   FLGI=0
                   INCR MSEC
                   MSEC$(MSEC)=CHR$(M)+CHR$(NIN)+CHR$(N)
                   print #4,msec"/"m"/"nin"/"n
                   GOTO NEXTN
                END IF
                IF CO$(M,N)="T" AND (CO$(M,N+1)<>"H" AND CO$(M,N+1)<>"U"_
                                AND CO$(M,N+1)<>"V" AND CO$(M,N+1)<>"T") THEN
                   FLGI=0
                   INCR MSEC
                   MSEC$(MSEC)=CHR$(M)+CHR$(NIN)+CHR$(N)
                   print #4,msec"/"m"/"nin"/"n
                   GOTO NEXTN
                END IF
              END IF
NEXTN:
           NEXT N

        NEXT M
        '......... SCANNING - fixo N varro os M's
        NSEC=0
        FOR N=1 TO NMAX

           FLGI=0
           FOR M=1 TO MMAX

              IF FLGI=0  THEN
                IF CO$(M,N)="T" THEN
                   FLGI=1
                   IF CO$(M-1,N)<>"H" AND CO$(M-1,N)<>"U" AND CO$(M-1,N)<>"V" _
                      THEN MIN=M ELSE MIN=M-1
                   GOTO NEXTM
                END IF
                GOTO NEXTM
              END IF

              IF FLGI=1  THEN
                IF CO$(M,N)="H" OR CO$(M,N)="U" OR CO$(M,N)="V" THEN
                   FLGI=0
                   INCR NSEC
                   NSEC$(NSEC)=CHR$(N)+CHR$(MIN)+CHR$(M)
                   print #4,nsec"/"n"/"min"/"m
                   GOTO NEXTM
                END IF
                IF CO$(M,N)="T" AND (CO$(M+1,N)<>"H" AND CO$(M+1,N)<>"U" _
                      AND CO$(M+1,N)<>"V"  AND CO$(M+1,N)<>"T") THEN
                   FLGI=0
                   INCR NSEC
                   NSEC$(NSEC)=CHR$(N)+CHR$(MIN)+CHR$(M)
                   print #4,Nsec"/"N"/"Min"/"M
                   GOTO NEXTM
                END IF
              END IF
NEXTM:
           NEXT M
```

```
        NEXT N
        RETURN
'.....
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'             SUBROTINA DE LEITURA DE DADOS DE CAMPO
'
'CRIADA EM :
'MODULO    : MDBD2701.BAS
'
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX


'.................SUBROTINA DE LEITURA - CAMPO.....................

LEITURA:

       OPEN "R",#2,DRIVE$+ARQCAMPO$+".DCA",19

       FIELD #2, 8 AS BARQ$, 2 AS BMAX$, 2 AS BNAX$,2 AS BNPON$, 5 AS BOB$
       GET #2,1
       MMAX=CVI(BMAX$)
       NMAX=CVI(BNAX$)
       NPON=CVI(BNPON$)
       MMIN=ID1
       NMIN=ID2
       FIELD #2,2 AS BM$,2 AS BN$,1 AS BC$,4 AS BZ$,4 AS BH$, _
              2 AS BU$,2 AS BV$,2 AS BK$

       FOR IR=11 TO NPON+10

          IF INKEY$=CHR$(27) THEN ESCAPE
          GET #2,IR
          M=CVI(BM$):N=CVI(BN$)
          CO$(M,N)=BC$
          Z(M,N)=CVS(BZ$):H(M,N)=CVS(BH$)
          U(M,N)=CSNG(CVI(BU$))/100:V(M,N)=CSNG(CVI(BV$))/100
          RK(M,N)=CSNG(CVI(BK$))/1000
          IF M<MMIN THEN MMIN=M
          IF N<NMIN THEN NMIN=N

       NEXT IR
       CLOSE #2
       RETURN
'.................................................................
```

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

'      SUBROTINA DE LEITURA DAS CONDICOES DE CONTORNO
'
'CRIADA     EM:
'ATUALIZADA EM:
'MODULO       : MDBD2801.BAS
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'.....................................................................
CONTORNO:

       XBMAX=0
       FOR I=1 TO NARCON

          OPEN "I",#1,DRIVE$+CON$(I)+".DCO"

            J=0
            WHILE NOT EOF(1)
               INCR J
               INPUT #1,XB(I,J),CB(I,J)
               IF XB(I,J)>XBMAX THEN XBMAX=XB(I,J)
            WEND
            NPCON(I)=J
          CLOSE #1

          MC=0:NC=0:NPA=0
          FOR L=1 TO LEN(LOCON$(I))
             AUX$=UCASE$(MID$(LOCON$(I),L,1))
             IF AUX$="X" THEN MC=VAL(MID$(LOCON$(I),L+1,2))
             IF AUX$="Y" THEN NC=VAL(MID$(LOCON$(I),L+1,2))
             IF AUX$="I" THEN INC=VAL(MID$(LOCON$(I),L+1,2))
             IF AUX$="F" THEN FIC=VAL(MID$(LOCON$(I),L+1,2))
             IF AUX$="D" THEN NPA=VAL(MID$(LOCON$(I),L+1,2))
          NEXT L

          IF MC>0 THEN
             FOR NC=INC TO FIC STEP SGN(FIC-INC)
                CO$(MC,NC)=LEFT$(CO$(MC,NC),1)+CHR$(I)
             NEXT NC
          ELSE
             FOR MC=INC TO FIC STEP SGN(FIC-INC)
                CO$(MC,NC)=LEFT$(CO$(MC,NC),1)+CHR$(I)
                NC=NC+NPA
             NEXT MC
          END IF
       NEXT I

       RETURN

'.....................................................................
```

BATIMETRIA DO ARQUIVO: capa - Cotas em m

YX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	YX
40	10.0	10.0	10.0	9.5	9.5	9.5	9.0	9.0	9.0	8.5	8.5	8.5	8.5	9.0	9.0	9.5	9.5	10.0	10.0	10.0	10.0	40
39	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	39
38	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	38
37	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	37
36	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	36
35	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	35
34	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	34
33	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	33
32	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	32
31	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	31
30	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	30
29	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	29
28	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	28
27	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	27
26	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	26
25	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	25
24	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	24
23	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	23
22	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	22
21	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	21
20	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	20
19	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	19
18	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	18
17	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	17
16	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	16
15	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	15
14	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	14
13	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	13
12	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	12
11	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	11
10	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	10
9	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	9
8	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	8
7	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	7
6	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	6
5	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	5
4	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	4
3	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	3
2	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	2
1	10.0	10.0	10.0	9.5	9.5	9.0	9.0	9.0	9.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0	10.0	10.0	1

RUGOSIDADES DO ARQUIVO: capa - K em mm

YX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	YX
40	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	40
39	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	39
38	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	38
37	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	37
36	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	36
35	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	35
34	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	34
33	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	33
32	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	32
31	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	31
30	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	30
29	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	29
28	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	28
27	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	27
26	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	26
25	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	25
24	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	24
23	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	23
22	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	22
21	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	21
20	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	20
19	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	19
18	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	18
17	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	17
16	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	16
15	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	15
14	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	14
13	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	13
12	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	12
11	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	11
10	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	10
9	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	9
8	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	8
7	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	7
6	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	6
5	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	5
4	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	4
3	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	3
2	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	2
1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	1

APÊNDICE III

III.1 EQUAÇÕES

As equações do modelo matemático misto para cálculo do escoamento em duas dimensões, proposto por LEENDERTSE (1967), são aqui desenvolvidas, para comparação com os resultados do modelo implícito MDBD, cujas equações são introduzidas no Capítulo 4.

As equações a seguir foram escritas para a malha de pontos da figura 3.1.2, segundo a técnica descrita no item 3.1. Os valores obtidos para a primeira etapa de cálculo (t + Δt/2) são armazenados em U',V' e h'. Os resultados da segunda etapa são reatribuídos às variáveis U, V e h.

■ Primeira Etapa (t + Δt/2):

$$A_{i,j} = h_{i,j} - \frac{1}{2}\frac{\Delta t}{\Delta y}\left[V_{i,j}\left(h_{i,j+1} + h_{i,j} - Z_{i,j} - Z_{i-1,j}\right) - V_{i,j-1}\left(h_{i,j} + h_{i,j-1} - Z_{i,j-1} - Z_{i-1,j-1}\right)\right] \qquad [III.1]$$

$$B_{i,j} = U_{i,j} - \frac{1}{4}\frac{\Delta t}{\Delta y}\left[V_{i,j-1} + V_{i,j} + V_{i+1,j-1} + V_{i+1,j}\right]$$

$$\left[\left(1-\gamma_{i,j}\right)\left(U_{i,j+1} - U_{i,j}\right) + \gamma_{i,j}\left(U_{i,j} - U_{i,j-1}\right)\right] -$$

$$- 8g\Delta t \frac{U_{i,j}\sqrt{(U_{i,j})^2 + \frac{1}{16}(V_{i,j-1} + V_{i,j} + V_{i+1,j-1} + V_{i+1,j})^2}}{(C_{i+1,j} + C_{i,j})^2 (h_{i+1,j} + h_{i,j} - Z_{i,j} - Z_{i,j-1})}$$

[III.2]

$$P_i = \frac{\frac{\Delta t}{2\Delta x}\left(h_{i+1,j} + h_{i,j} - Z_{i,j} - Z_{i,j-1}\right)}{1 + \frac{\Delta t}{2\Delta x}\left(h_{i-1,j} + h_{i,j} - Z_{i-1,j} - Z_{i-1,j-1}\right) R_{i-1}}$$

[III.3

$$Q_i = \frac{A_{i,j} + \frac{\Delta t}{2\Delta x}\left(h_{i-1,j} + h_{i,j} - Z_{i-1,j} - Z_{i-1,j-1}\right) S_{i-1}}{1 + \frac{\Delta t}{2\Delta x}\left(h_{i-1,j} + h_{i,j} - Z_{i-1,j} - Z_{i-1,j-1}\right) R_{i-1}}$$

[III.4]

$$R_i = \frac{g\frac{\Delta t}{\Delta x}}{1 + g\frac{\Delta t}{\Delta x} P_i + \frac{\Delta t}{\Delta y}\left[(1-\alpha_{i,j})(U_{i+1,j} - U_{i,j}) + \alpha_{i,j}(U_{i,j} - U_{i-1,j})\right]}$$

[III.5]

$$S_i = \frac{g\,\frac{\Delta t}{\Delta x}\,Q_i + B_i}{1+g\,\frac{\Delta t}{\Delta x}\,P_i + \frac{\Delta t}{\Delta y}\left[(1-\alpha_{i,j})(U_{i+1,j} - U_{i,j}) + \alpha_{i,j}(U_{i,j} - U_{i-1,j})\right]}$$

$$h'_{i,j} = - P_i\, U'_{i,j} + Q_i$$

$$U'_{i-1,j} = - R_{i-1}\, h'_{i,j} + S_{i-1} \qquad \text{[III.6]}$$

$$V'_{i,j} = \left\{ V'_{i,j} - \frac{1}{4}\,\frac{\Delta t}{\Delta x}(U'_{i,j} + U'_{i,j+1} + U'_{i-1,j} + U'_{i-1,j+1}) \circ \right.$$

$$\circ \left[(1 - \gamma_{i,j})(V_{i+1,j} - V_{i,j}) + \gamma_{i,j}(V_{i,j} - V_{i-1,j})\right] -$$

$$\left. - g\,\frac{\Delta t}{\Delta x}(h_{i,j+1} - h_{i,j}) \right\} +$$

$$+ \left\{ 1 + \frac{\Delta t}{\Delta y}\left[(1-\beta_{i,j})(V_{i,j+1} - V_{i,j}) + \beta_{i,j}(V_{i,j} - V_{j,1})\right] + \right.$$

$$\left. + 8g\Delta t\, \frac{\sqrt{\frac{1}{16}(U'_{i,j} + U'_{i,j+1} + U'_{i-1,j} + U'_{i-1,j+1})^2 + (V_{i,j})^2}}{\left(C_{i,j+1} + C_{i,j}\right)^2 \left(h'_{i,j+1} + h'_{i,j} - Z_{i-1,j} - Z_{i,j}\right)} \right\} \qquad \text{[III.7]}$$

■ Para a segunda etapa (t+ Δt):

$$A_j = h'_{i,j} - \frac{\Delta t}{2\Delta x}\left[U'_{i,j}\left(h'_{i,j} + h'_{i+1,j} - Z_{i,j} - Z_{i,j-1}\right) - V'_{i-1,j}\left(h'_{i,j} + h'_{i-1,j} - Z_{i-1,j} - Z_{i-1,j-1}\right)\right]$$

[III.8]

$$B_j = V'_{i,j} - \frac{1}{4}\frac{\Delta t}{\Delta x}\left(U'_{i,j} + U'_{i,j+1} + U'_{i-1,j} + U'_{i-1,j+1}\right) \circ \left[\left(1-\gamma_{i,j}\right)\left(V'_{i+1,j} - V'_{i,j}\right) + \gamma_{i,j}\left(V'_{i,j} - V'_{i-1,j}\right)\right] -$$

$$- 8g\Delta t \frac{V'_{i,j}\sqrt{\left(U'_{i,j} + U'_{i,j+1} + U'_{i-1,j} + U'_{i-1,j+1}\right)^2 \frac{1}{16} + \left(V'_{i,j}\right)^2}}{\left(C_{i,j+1} + C_{i,j}\right)^2 \left(h'_{i,j+1} + h'_{i,j} - Z_{i,j} - Z_{i-1,j}\right)}$$

[III.9]

$$R_j = \frac{g\frac{\Delta t}{\Delta y}}{1+g\frac{\Delta t}{\Delta y}P_j + \frac{\Delta t}{\Delta x}\left[\left(1-\beta_{i,j}\right)\left(V'_{i,j+1} - V'_{i,j}\right) + \beta_{i,j}\left(V'_{i,j} - V'_{i,j-1}\right)\right]}$$

[III.10]

$$P_j = \frac{\frac{\Delta t}{2\Delta y}\left(h'_{i,j+1} + h'_{i,j} - Z_{i+1,j} - Z_{i,j}\right)}{1 + \frac{\Delta t}{2\Delta y}\left(h'_{i,j} + h'_{i,j-1} - Z_{i,j-1} - Z_{i-1,j-1}\right)R_{j-1}}$$

[III.11]

$$S_j = \frac{B_j + g \frac{\Delta t}{\Delta g} Q_j}{1+g \frac{\Delta t}{\Delta y} P_j + \frac{\Delta t}{\Delta x}\left[(1-\beta_{i,j})(V'_{i,j+1} - V'_{i,j}) + \beta_{i,j}(V'_{i,j} - V'_{i,j-1})\right]}$$

[III.12]

$$Q_j = \frac{A_j + \frac{\Delta t}{2\Delta y}\left(h'_{i,j} + h'_{i,j-1} - Z_{i,j-1} - Z_{i-1,j-1}\right) S_{i-1}}{1 + \frac{\Delta t}{2y}\left(h'_{i,j} + h'_{i,j-1} - Z_{i,j-1} - Z_{i-1,j-1}\right) R_{j-1}}$$

[III.13]

$$h_{i,j} = - Q_j - P_j V_{i,j}$$

$$V_{i,j-1} = S_{j-1} - R_{j-1} h_{i,j}$$

[III.14]

$$U_{i,j} = \left\{ U'_{i,j} - \frac{1}{4} \frac{\Delta t}{\Delta x}(V_{i,j-1} + V_{i,j+1} + V_{i+1,j} + V_{i+1,j-1}) \circ \right.$$

$$\circ \left[(1 - \gamma_{i,j})(U'_{i,j+1} - U'_{i,j}) + \gamma_{i,j}(U'_{i,j} - U'_{i,j-1})\right] -$$

$$\left. - g \frac{\Delta t}{\Delta x}(h'_{i+1,j} - h'_{i,j}) \right\} +$$

$$\left\{ 1 + \frac{\Delta t}{\Delta x} \left[(1-\alpha_{i,j}) (U'_{i+1,j} - U'_{i,j}) + \alpha_{i,j} (U'_{i,j} - U'_{i-1,j}) \right] + \right.$$

$$\left. + 8g\Delta t \frac{\sqrt{(U'_{i,j})^2 + \frac{1}{16} (V_{i,j-1} + V_{i,j} + V_{i+1,j} + V_{i+1,j-1})^2}}{\left(C_{i+1,j} + C_{i,j}\right)^2 \left(h_{i+1,j} + h_{i,j} - Z_{i,j} - Z_{i,j-1}\right)} \right\}$$

[III.15]

III.2 LISTAGENS DOS PROGRAMAS

A seguir é apresentada a listagem do módulo de cálculo elaborado em linguagem BASIC para a rotina do modelo de LEENDERTSE. Esta rotina foi idealizada de modo a utilizar os mesmos subprogramas de entrada de dados, telas e resultados do modelo MDBD, cujas listagens são apresentadas no Apêndice II. Para a utilização do modelo de LEENDERTSE, é necessário apenas substituir o módulo MDBD1305 pelo módulo MDBD1302.BAS.

```
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
'
'    MODELO HIDRODINAMICO BIDIMENSIONAL - MODULO DE CALCULO
'                   MODELO DE LEENDERTSE
'                          MDBD1302
'
'
' MODULO        :MDBD1302.BAS
' CRIADO    EM : 22/08/1989              POR:  RODOLFO
' ATUALIZADA EM: 25/08/1989              POR:
'
'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX


'.........................CALCULOS PRELIMINARES .........................

       AY     = AX

       ATX    = ATC/AX
       ATX2   = ATC/2/AX
       ATX4   = ATC/4/AX
       ATGRAVX=ATC*GRAV/AX

       ATY    = ATC/AY
       ATY2   = ATC/2/AY
       ATY4   = ATC/4/AY
       ATGRAVY= ATC*GRAV/AY

       AT8GRAV= 8*ATC*GRAV

       FATOR  = ATC/ATD
       TEMPO  = 0
       NITERA = 1

'.......................INICIALIZA ARQUIVO DE RESULTADOS..................

       LOCATE 23,42,0:COLOR 23,0:PRINT "G R A V A N D O";:COLOR 7,0

       OPEN "R",#1,DRIVESPOOL$+"MDBDRES.AUX",10
         IF LOF(1)<>0 THEN
            CLOSE #1
             SHELL "COPY "+DRIVESPOOL$+"MDBDRES.AUX "+DRIVESPOOL$+"MDBDRES.BBK >D:DUMMY"
            KILL DRIVESPOOL$+"MDBDRES.AUX"
            OPEN "R",#1,DRIVESPOOL$+"MDBDRES.AUX",10
         END IF

         FIELD #1,10 AS BTITCAMP$
           LSET BTITCAMP$=ARQCAMPO$
           PUT #1,1

           LSET BTITCAMP$=TITSIMUL$
           PUT #1,2

         FIELD #1, 2 AS BMMAX$, 2 AS BNMAX$, 4 AS BAX$, 2 AS BOP$
           LSET BMMAX$=MKI$(MMAX):LSET BNMAX$=MKI$(NMAX)
           LSET BAX$=MKS$(AX):LSET BOP$=""
           PUT #1,3

           LSET BMMAX$=MKI$(ATD):LSET BNMAX$=MKI$(ATC)
           LSET BAX$="":LSET BOP$=MKI$(IOPS)
           PUT #1,4
           RREG=4

           INCR RREG
           PREG=RREG
           NPG=0
         FIELD #1, 1 AS BM$,1 AS BN$,2 AS BU$,2 AS BV$,4 AS BH$
            FOR M=1 TO MMAX
               FOR N=1 TO NMAX
                  C$=LEFT$(CO$(M,N),1)
                  IF C$="T" OR C$="H" OR C$="U" OR C$="V" THEN
                      LSET BM$=CHR$(M):LSET BN$=CHR$(N)
                      LSET BU$=MKI$(INT(U(M,N)*100))
                      LSET BV$=MKI$(INT(V(M,N)*100))
                      LSET BH$=MKS$(H(M,N))
                      INCR RREG
                      PUT #1,RREG
                      INCR NPG
```

```
            END IF
          NEXT N
        NEXT M
      FIELD #1,4 AS BTEMPO$,2 AS BNPG$, 4 AS BOP$
        LSET BTEMPO$=MKS$(TEMPO):LSET BNPG$=MKI$(NPG):LSET BOP$=""
        PUT #1,PREG
        LOCATE 23,42,0:PRINT "                ";
    CLOSE #1


'..................... INICIO DO LOOP DE TEMPO
    ON KEY(3) GOSUB KEY3:KEY(3) ON
    ON KEY(5) GOSUB KEY5:KEY(5) ON

    DO

                    '************************
                       TEMPO=TEMPO+FATOR
                    '************************


    LOCATE 17,41:PRINT USING "CALCULANDO INSTANTE ##### s/###.### h";TEMPO$ATD;TEMPO$ATD/3600;
    STP=1
    LOCATE 18,41:PRINT USING "STEP=##";STP
    '...Calculo de U' e H' no Primeiro Intervalo para os M's de um N

      FOR NS=1 TO NSEC

        JJ=ASC(LEFT$(NSEC$(NS),1))
        MIN=ASC(MID$(NSEC$(NS),2,1))
        MIF=ASC(RIGHT$(NSEC$(NS),1))
        LOCATE 20,52:PRINT USING "N=###";JJ;
        ITERA=1

      '.....condicao de contorno de montante

        II=MIN:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
        C$=LEFT$(CO$(I0,JJ),1)
        C(II,JJ)=FNC(H(II,JJ)-Z(II,JJ),RK(II,JJ))
        C(I0,JJ)=C(II,JJ)
        LOCATE 20,42:PRINT USING "M=###";I0;

        IF C$<>"H" AND C$<>"U" THEN
           R(I0)=0:S(I0)=0
           H(I0,JJ)=0:HP(I0,JJ)=0
           GOTO FORPII
        ELSE
           NCONT=ASC(RIGHT$(CO$(I0,JJ),1))
           FOR LL=1 TO NPCON(NCONT)
              XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
           NEXT LL
           FUN=FNPINT(NPCON(NCONT),TEMPO)
        END IF
        IF C$="U" THEN
           R(I0)=0:S(I0)=FUN
           H(I0,JJ)=0:HP(I0,JJ)=0
           GOTO FORPII
        END IF
        IF C$="H" THEN
           HP(I0,JJ)=FUN
           C(I0,JJ)=FNC(H(I0,JJ)-Z(I0,JJ),RK(I0,JJ))

           GM=0.5:AF=1
           IF U(I0,J1)=0 THEN UI0J1=U(I0,J0) ELSE UI0J1=U(I0,J1)
           IF U(I0,J0)=0 THEN UI0J0=U(I0,J1) ELSE UI0J0=U(I0,J0)

           R(I0)=ATGRAVX/(1+ATY$((1-AF)$(U(II,JJ)-U(I0,JJ))))
           S(I0)=(ATGRAVX$HP(I0,JJ)+U(I0,JJ)-ATGRAV$U(I0,JJ)$
                 SQR(U(I0,JJ)^2+(V(II,JJ)+V(II,J0))^2/16)/(H(I0,JJ)+_
                 H(II,JJ)-Z(I0,JJ)-Z(I0,J0))/(C(I0,JJ)+C(II,JJ))^2-_
                 ATY4$(V(II,JJ)+V(II,J0))$((1-GM)$(UI0J1-U(I0,JJ))+_
                 GM$(U(I0,JJ)-UI0J0)))/(1+ATY$((1-AF)$(U(II,JJ)-U(I0,JJ))))

           GOTO FORPII
        END IF
```

```
'.............loop dos pontos intermediarios

FORPII:
   LOCATE 18,59:PRINT USING "ITERACAO=##";ITERA

   FOR II=MIN TO MIF
      I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
      LOCATE 20,42:PRINT USING "M=###";II;

      IF H(II,J1)=0 THEN HIJ1=2#H(II,JJ)-H(II,J0) ELSE HIJ1=H(II,J1)
      IF H(II,J0)=0 THEN HIJ0=2#H(II,JJ)-H(II,J1) ELSE HIJ0=H(II,J0)


      IF ITERA=1 THEN
         HIJ=H(II,JJ)
         IF H(I1,JJ)=0 THEN HI1J=2#H(II,JJ)-H(I0,JJ) ELSE HI1J=H(I1,JJ)
         IF H(I0,JJ)=0 THEN HI0J=2#H(II,JJ)-H(I1,JJ) ELSE HI0J=H(I0,JJ)
      ELSE
         HIJ=HP(II,JJ)
         IF HP(I1,JJ)=0 THEN HI1J=2#HP(II,JJ)-HP(I0,JJ) ELSE HI1J=HP(I1,JJ)
         IF HP(I0,JJ)=0 THEN HI0J=2#HP(II,JJ)-HP(I1,JJ) ELSE HI0J=HP(I0,JJ)
      END IF


      AI = H(II,JJ) -
           ATY2#(V(II,JJ)#(HIJ1+H(II,JJ)-Z(II,JJ)-Z(I0,JJ)) -
           V(II,J0)#(H(II,JJ)+HIJ0-Z(II,J0)-Z(I0,J0)))':? II,JJ,"AI="AI
      P(II) = (ATX2#(HI1J+HIJ-Z(II,JJ)-Z(II,J0)))/
              (1 + ATX2#R(I0)#(HI0J+HIJ-Z(I0,JJ)-Z(I0,J0)))':? II,JJ,"P="P(II)
      Q(II) = (AI+ATX2#S(I0)#(HI0J+HIJ-Z(I0,JJ)-Z(I0,J0)))/
              (1 + ATX2#R(I0) # (HI0J+HIJ-Z(I0,JJ)-Z(I0,J0)))':? II,JJ,"Q="Q(II)

      IF II=MIF THEN EXIT FOR

      C(I1,JJ)=FNC(HI1J-Z(I1,JJ),RK(I1,JJ))
      IF U(II,J1)=0 THEN UIJ1=U(II,J0) ELSE UIJ1=U(II,J1)
      IF U(II,J0)=0 THEN UIJ0=U(II,J1) ELSE UIJ0=U(I0,J0)
      GM=.5:AF=.5

      BI = U(II,JJ) - ATY4#(V(II,J0)+V(II,JJ)+V(I1,J0)+V(I1,JJ))# _
           ((1-GM)#(UIJ1-U(II,JJ))+GM#(U(II,JJ)-UIJ0)) - _
           AT8GRAV#U(II,JJ)#
           SQR(U(II,JJ)^2+(V(II,J0)+V(II,JJ)+V(I1,J0)+V(I1,JJ))^2/16)/
           ((C(II,JJ)+C(II,JJ))^2#(H(II,JJ)+H(II,JJ)-Z(II,JJ)-Z(II,J0))':?? II,JJ,"B="BI
      R(II) = ATGRAVX / (1 + ATGRAVX#P(II) +
              ATY#((1-AF)#(U(I1,JJ)-U(II,JJ))+AF#(U(II,JJ)-U(I0,JJ))))':? II,JJ,"R="R(II)
      S(II) = (ATGRAVX#Q(II) + BI)/ (1 + ATGRAVX#P(II) +
              ATY#((1-AF)#(U(I1,JJ)-U(II,JJ))+AF#(U(II,JJ)-U(I0,JJ))))':? II,JJ,"S="S(II)

   NEXT II

'..... condicao de contorno de jusante

   II=MIF:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
   C$=LEFT$(CO$(I1,JJ),1)
   LOCATE 20,42:PRINT USING "M=###";I1;

   IF C$<>"H" AND C$<>"U" THEN
      UP(I1,JJ)=0
      UP(II,JJ)=0'UP(I0,JJ)/2
      GOTO FORHUII
   ELSE
      NCONT=ASC(RIGHT$(CO$(I1,JJ),1))
      FOR LL=1 TO NPCON(NCONT)
         XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
   END IF

   IF C$="U" THEN
      UP(I1,JJ)=FUN
      UP(II,JJ)=(FUN+UP(I0,JJ))/2
      GOTO FORHUII
   END IF

   IF C$="H" THEN
      HP(I1,JJ)=FUN
```

```
      IF U(II,J1)=0 THEN UIJ1=U(II,J0) ELSE UIJ1=U(II,J1)
      IF U(II,J0)=0 THEN UIJ0=U(II,J1) ELSE UIJ0=U(I0,J0)
      AF=0:GM=0.5
      BI = U(II,JJ) - ATY4*(V(II,J0)+V(II,JJ))*
           ((1-GM)*(UIJ1-U(II,JJ))+GM*(U(II,JJ)-UIJ0)) - _
           ATBGRAV*U(II,JJ)*
           SQR(U(II,JJ)^2+(V(II,J0)+V(II,JJ))^2/16)/
           ((C(I1,JJ)+C(II,JJ))^2*(H(I1,JJ)+H(II,JJ)-Z(II,JJ)-Z(II,J0)))
      R(II) = ATGRAVX / (1 + ATGRAVX*P(II) + _
              ATY*(AF*(U(II,JJ)-U(I0,JJ))))
      S(II) = (ATGRAVX*Q(II) + BI)/ (1 + ATGRAVX*P(II) + _
              ATY*(AF*(U(II,JJ)-U(I0,JJ))))

      UP(II,JJ)=-R(II)*HP(I1,JJ)+S(II)

      GOTO FORHUII
   END IF

'.....calculo dos HP e UP nas linhas N

FORHUII:
   FOR II=MIF TO MIN STEP -1
      HP(II,JJ)=-P(II)*UP(II,JJ)+Q(II)
      UP(II-1,JJ)=-R(II-1)*HP(II,JJ)+S(II-1)
   NEXT II

'..Verifica Necessidade de iteracao
   IF ITERA<NITERA THEN ITERA=ITERA+1:GOTO FORPII

NEXT NS


'..Calculo dos V' no primeiro Intervalo de Tempo

FOR MS=1 TO MSEC

   II=ASC(LEFT$(MSEC$(MS),1))
   NIN=ASC(MID$(MSEC$(MS),2,1))
   NIF=ASC(RIGHT$(MSEC$(MS),1))
   LOCATE 21,42:PRINT USING "M=###";II;

'........condicao de contorno a montante

   JJ=NIN:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
   C$=LEFT$(CO$(II,J0),1)
   C(II,JJ)=FNC(H(II,JJ)-Z(II,JJ),RK(II,JJ))
   C(II,J0)=C(II,JJ)
   LOCATE 21,52:PRINT USING "N=###";J0;

   IF C$<>"H" AND C$<>"V" THEN
      VP(II,J0)=0

      GOTO FORJJ
   ELSE
      NCONT=ASC(RIGHT$(CO$(II,J0),1))
      FOR LL=1 TO NPCON(NCONT)
         XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
   END IF
   IF C$="V" THEN
      VP(II,J0)=FUN
      GOTO FORJJ
   END IF
   IF C$="H" THEN
      HP(II,J0)=FUN
      C(II,J0)=FNC(H(II,J0)-Z(II,J0),RK(II,J0))
      BT=1:DL=.5
      IF V(I1,J0)=0 THEN VI1J0=V(I0,J0) ELSE VI1J0=V(I1,J0)
      IF V(I0,J0)=0 THEN VI0J0=V(I1,J0) ELSE VI0J0=V(I0,J0)

      AUX=V(II,J0)-ATX4*(UP(II,JJ)+UP(I0,JJ))
          *((1-DL)*(VI1J0-V(II,J0))+DL*(V(II,J0)-VI0J0)) - _
           ATGRAVX*(H(II,JJ)-H(II,J0))
      VP(II,J0) = AUX /_
```

```
          (1+ATY$((1-BT)$(V(II,JJ)-V(II,J0)))+_
          AT8GRAV$
          SQR(V(II,J0)^2+(UP(II,JJ)+UP(I0,JJ))^2/16)/_
          ((C(II,JJ)+C(II,J0))^2$(HP(II,J0)+HP(II,JJ)-Z(I0,J0)-Z(II,J0))))

       GOTO FORJJ
    END IF

'.........loop dos pontos intermediarios

FORJJ:
    FOR JJ=NIN TO NIF-1
       J0=JJ-1:J1=JJ+1
       C(II,J1)=FNC(H(II,J1)-Z(II,J1),RK(II,J1))
       LOCATE 21,52:PRINT USING "N=###";JJ;

       BT=.5:DL=.5
       IF V(I1,JJ)=0 THEN VI1J=V(I0,JJ) ELSE VI1J=V(I1,JJ)
       IF V(I0,JJ)=0 THEN VI0J=V(I1,JJ) ELSE VI0J=V(I0,JJ)

       AUX=V(II,JJ)-ATX4$(UP(II,JJ)+UP(II,J1)+UP(I0,JJ)+UP(I0,J1))_
           $((1-DL)$(VI1J-V(II,JJ))+DL$(V(II,JJ)-VI0J)) - _
            AT8GRAVX$(H(II,J1)-H(II,JJ))
       VP(II,JJ) = AUX /
           (1+ATY$((1-BT)$(V(II,J1)-V(II,JJ))+BT$(V(II,JJ)-V(II,J0)))+_
           AT8GRAV$
           SQR(V(II,JJ)^2+(UP(II,JJ)+UP(II,J1)+UP(I0,JJ)+UP(I0,J1))^2/16)/_
           ((C(II,J1)+C(II,JJ))^2$(HP(II,J1)+HP(II,JJ)-Z(I0,JJ)-Z(II,JJ))))

    NEXT JJ

'........ condicao de contorno a jusante

    JJ=NIF:J0=JJ-1:J1=JJ+1
    C$=LEFT$(CO$(II,J1),1)

    LOCATE 21,52:PRINT USING "N=###";J1;

    IF C$<>"H" AND C$<>"V" THEN
       VP(II,JJ)=0'VP(II,J0)/2
    ELSE
       NCONT=ASC(RIGHT$(CO$(II,J1),1))
       FOR LL=1 TO NPCON(NCONT)
          XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
       NEXT LL
       FUN=FNPINT(NPCON(NCONT),TEMPO)
    END IF

    IF C$="V" THEN
       VP(II,J1)=FUN
       VP(II,JJ)=(VP(II,J1)+VP(II,JJ))/2
    END IF

    IF C$="H" THEN

       HP(II,J1)=FUN
       IF V(I1,JJ)=0 THEN VI1J=V(I0,JJ) ELSE VI1J=V(I1,JJ)
       IF V(I0,JJ)=0 THEN VI0J=V(I1,JJ) ELSE VI0J=V(I0,JJ)
       BT=0:DL=0.5
       IF H(II,J1)=0 THEN HIJ1=2$H(II,JJ)-H(II,J0) ELSE HIJ1=H(II,J1)
       C(II,J1)=FNC(HIJ1-Z(II,J1),RK(II,J1))

       AUX=V(II,JJ)-ATX4$(UP(II,JJ)+UP(I0,JJ))
           $((1-DL)$(VI1J-V(II,JJ))+DL$(V(II,JJ)-VI0J)) - _
            AT8GRAVX$(H(II,J1)-H(II,JJ))
       VP(II,JJ) = AUX /
           (1+ATY$(BT$(V(II,JJ)-V(II,J0)))+_
           AT8GRAV$
           SQR(V(II,JJ)^2+(UP(II,JJ)+UP(I0,JJ))^2/16)/_
           ((C(II,J1)+C(II,JJ))^2$(HP(II,J1)+HP(II,JJ)-Z(I0,JJ)-Z(II,JJ))))

    END IF

NEXT MS

          '$$$$$$$$$$$$$$$$$$$$$$$$
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```
              TEMPO=TEMPO+FATOR
            '$$$$$$$$$$$$$$$$$$$$$$$$$
LOCATE 17,41:PRINT USING "CALCULANDO INSTANTE ##### s/###.### h";TEMPO$ATD;TEMPO$ATD/3600;
STP=2
ON KEY(9) GOSUB KEY9:KEY(9) ON
LOCATE 18,41:PRINT USING "STEP=##";STP

'...Calculo de V' e H' no Segundo Intervalo para os N's de um M

  FOR MS=1 TO MSEC

     II=ASC(LEFT$(MSEC$(MS),1))
     NIN=ASC(MID$(MSEC$(MS),2,1))
     NIF=ASC(RIGHT$(MSEC$(MS),1))
     LOCATE 20,42:PRINT USING "M=###";II;
     ITERA=1

  '.....contorno de montante
     JJ=NIN:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
     C$=LEFT$(CO$(II,J0),1)
     LOCATE 20,52:PRINT USING "N=###";J0;

     IF C$<>"H"  AND C$<>"V" THEN
        R(J0)=0:S(J0)=0
        H(II,J0)=0:HP(II,J0)=0
        GOTO FORPJJ
     ELSE
        NCONT=ASC(RIGHT$(CO$(II,J0),1))
        FOR LL=1 TO NPCON(NCONT)
           XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
        NEXT LL
        FUN=FNPINT(NPCON(NCONT),TEMPO)
     END IF
     IF C$="V" THEN
        R(J0)=0:S(J0)=FUN
        H(II,J0)=0:HP(II,J0)=0
        GOTO FORPJJ
     END IF

     IF C$="H" THEN
        H(II,J0)=FUN

        BT=1:DL=0.5
        IF VP(I1,J0)=0 THEN VPI1J0=VP(I0,J0) ELSE VPI1J0=VP(I1,J0)
        IF VP(I0,J0)=0 THEN VPI0J0=VP(I1,J0) ELSE VPI0J0=VP(I0,J0)

        R(J0)=ATGRAVY/(1+ATX$((1-BT)$(VP(II,JJ)-VP(II,J0))))
        S(J0)=(ATGRAVY$H(II,J0) + VP(II,J0)-AT8GRAV$VP(II,J0)$_
              SQR(VP(II,J0)^2+(UP(II,JJ)+UP(I0,JJ))^2/16)/_
              (HP(II,J0)+HP(II,JJ)-Z(I0,J0)-Z(II,J0))/(C(II,J0)+_
              C(II,JJ))^2-ATX4$((1-DL)$(VPI1J0-VP(II,J0))+DL$_
              (VP(II,J0)-VPI0J0))$(UP(II,JJ)+UP(I0,JJ)))/_
              (1+ATX$((1-BT)$(VP(II,JJ)-VP(II,J0))))
        GOTO FORPJJ
     END IF

  '..............loop dos pontos intermediarios
  FORPJJ:
     LOCATE 18,59:PRINT USING "ITERACAO=##";ITERA

     FOR JJ=NIN TO NIF
        J0=JJ-1:J1=JJ+1
        LOCATE 20,52:PRINT USING "N=###";JJ;

        IF HP(I1,JJ)=0 THEN HPI1J=2$HP(II,JJ)-HP(I0,JJ) ELSE HPI1J=HP(I1,JJ)
        IF HP(I0,JJ)=0 THEN HPI0J=2$HP(II,JJ)-HP(I1,JJ) ELSE HPI0J=HP(I0,JJ)

        IF ITERA=1 THEN
           HPIJ=HP(II,JJ)
           IF HP(II,J1)=0 THEN HPIJ1=2$HP(II,JJ)-HP(II,J0) ELSE HPIJ1=HP(II,J1)
           IF HP(II,J0)=0 THEN HPIJ0=2$HP(II,JJ)-HP(II,J1) ELSE HPIJ0=HP(II,J0)
        ELSE
           HPIJ=H(II,JJ)
           IF H(II,J1)=0 THEN HPIJ1=2$H(II,JJ)-H(II,J0) ELSE HPIJ1=H(II,J1)
           IF H(II,J0)=0 THEN HPIJ0=2$H(II,JJ)-H(II,J1) ELSE HPIJ0=H(II,J0)
        END IF
```

```
      AJ=HP(II,JJ)-ATX2*(UP(II,JJ)*(HP(II,JJ)+HPI1J-Z(II,JJ)-Z(II,J0))-_
           UP(I0,JJ)*(HP(II,JJ)+HPI0J-Z(I0,JJ)-Z(I0,J0)))
      P(JJ)=(ATY2*(HPIJ1+HPIJ-Z(II,JJ)-Z(I0,JJ)))/
           (1 + ATY2*R(J0) * (HPIJ+HPIJ0-Z(II,J0)-Z(I0,J0)))
      Q(JJ)=(AJ+ATY2*S(J0)*(HPIJ+HPIJ0-Z(II,J0)-Z(I0,J0)))/ _
           (1 + ATY2*R(J0)*(HPIJ+HPIJ0-Z(II,J0)-Z(I0,J0)))

      IF JJ=NIF THEN EXIT FOR

      BT=0.5:DT=0.5
      IF VP(I1,JJ)=0 THEN VPI1J=VP(I0,JJ) ELSE VPI1J=VP(I1,JJ)
      IF VP(I0,JJ)=0 THEN VPI0J=VP(I1,JJ) ELSE VPI0J=VP(I0,JJ)

      BJ = VP(II,JJ) - ATX4*(UP(II,JJ)+UP(II,J1)+UP(I0,JJ)+UP(I0,J1))* _
           ((1-DL)*(VPI1J-VP(II,JJ))+DL*(VP(II,JJ)-VPI0J)) - _
           AT8GRAV*VP(II,JJ)*
           SQR(VP(II,JJ)^2+(UP(II,JJ)+UP(II,J1)+UP(I0,JJ)+UP(I0,J1))^2/16)/_
           ((C(II,J1)+C(II,JJ))^2*(HP(II,J1)+HP(II,JJ)-Z(II,JJ)-Z(I0,JJ)))
      R(JJ) = ATGRAVY / (1 + ATGRAVY*P(JJ) +
         ATX*((1-BT)*(VP(II,J1)-VP(II,JJ))+BT*(VP(II,JJ)-VP(II,J0))))
      S(JJ) = (ATGRAVY*Q(JJ) + BJ)/ (1 + ATGRAVY*P(JJ) +
         ATX*((1-BT)*(VP(II,J1)-VP(II,JJ))+BT*(VP(II,JJ)-VP(II,J0))))

   NEXT JJ

'.....condicao de contorno de jusante

   JJ=NIF:J0=JJ-1:J1=JJ+1
   C$=LEFT$(CO$(II,J1),1)
   LOCATE 20,52:PRINT USING "N=###";J1;

   IF C$<>"H"  AND C$<>"V" THEN
      V(II,J1)=0
      V(II,JJ)=0'V(II,J0)/2
      GOTO FORHUJJ
   ELSE
      NCONT=ASC(RIGHT$(CO$(II,J1),1))
      FOR LL=1 TO NPCON(NCONT)
         XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
   END IF

   IF C$="V" THEN
      V(II,J1)=FUN
      V(II,JJ)=(FUN+V(II,J0))/2
      GOTO FORHUJJ
   END IF

   IF C$="H" THEN

      H(II,J1)=FUN

      DL=0.5:BT=0
      IF VP(I1,JJ)=0 THEN VPI1J=VP(I0,JJ) ELSE VPI1J=VP(I1,JJ)
      IF VP(I0,JJ)=0 THEN VPI0J=VP(I1,JJ) ELSE VPI0J=VP(I0,JJ)

      BJ = VP(II,JJ) - ATX4*(UP(II,JJ)+UP(I0,JJ))*
           ((1-DL)*(VPI1J-VP(II,JJ))+DL*(VP(II,JJ)-VPI0J)) - _
           AT8GRAV*VP(II,JJ)*
           SQR(VP(II,JJ)^2+(UP(II,JJ)+UP(I0,JJ))^2/16)/
           ((C(II,J1)+C(II,JJ))^2*(HP(II,J1)+HP(II,JJ)-Z(II,JJ)-Z(I0,JJ)))
      R(JJ) = ATGRAVY / (1 + ATGRAVY*P(JJ) + _
         ATX*(BT*(VP(II,JJ)-VP(II,J0))))
      S(JJ) = (ATGRAVY*Q(JJ) + BJ)/ (1 + ATGRAVY*P(JJ) + _
         ATX*(BT*(VP(II,JJ)-VP(II,J0))))
      V(II,JJ)=-R(JJ)*H(II,J1)+S(JJ)
      GOTO FORHUJJ
   END IF

'.....calculo dos H e V na Coluna M
FORHUJJ:
   FOR JJ=NIF TO NIN STEP -1
      H(II,JJ)=-P(JJ)*V(II,JJ)+Q(JJ)
      V(II,JJ-1)=-R(JJ-1)*H(II,JJ)+S(JJ-1)
```

```
    NEXT JJ

  '..Verifica Necessidade de iteracao
    IF ITERA<NITERA THEN ITERA=ITERA+1:GOTO FORPJJ

  NEXT MS


'..Calculo de U no Segundo Intervalo de Tempo nos M's de um N

  FOR NS=1 TO NSEC

    JJ=ASC(LEFT$(NSEC$(NS),1))
    MIN=ASC(MID$(NSEC$(NS),2,1))
    MIF=ASC(RIGHT$(NSEC$(NS),1))
    LOCATE 21,52:PRINT USING "N=###";JJ

  '........condicao de contorno a montante

    II=MIN:I0=II-1:J0=JJ-1:I1=II+1:J1=JJ+1
    C$=LEFT$(CO$(I0,JJ),1)
    LOCATE 21,42:PRINT USING "M=###";I0;

    IF C$<>"H" AND C$<>"U" THEN
      U(I0,JJ)=0
      GOTO FORII
    ELSE
    NCONT=ASC(RIGHT$(CO$(I0,JJ),1))
      FOR LL=1 TO NPCON(NCONT)
        XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
    END IF
    IF C$="U" THEN
      U(I0,JJ)=FUN
      GOTO FORII
    END IF

    IF C$="H" THEN
      H(I0,JJ)=FUN
      IF UP(I0,J1)=0 THEN UPI0J1=UP(I0,J0) ELSE UPI0J1=UP(I0,J1)
      IF UP(I0,J0)=0 THEN UPI0J0=UP(I0,J1) ELSE UPI0J0=UP(I0,J0)
      AF=1:GM=.5

      AUX=UP(I0,JJ)-ATY4$(V(II,JJ)+V(II,J0))
        $((1-GM)$(UPI0J1-UP(II,JJ))+GM$(UP(II,JJ)-UPI0J0)) - _
        ATGRAVY$(HP(II,JJ)-HP(I0,JJ))

      U(I0,JJ) = AUX/(1+ATX$((1-AF)$(UP(II,JJ)-UP(I0,JJ)))+_
          AT86RAV$ SQR(UP(I0,JJ)^2+(V(II,JJ)+V(II,J0))^2/16)/
          ((C(II,JJ)+C(I0,JJ))^2$(H(I0,JJ)+H(II,JJ)-Z(I0,JJ)-Z(I0,J0))))

      GOTO FORII
    END IF

  '.........loop dos pontos intermediarios

  FORII:
    FOR II=MIN TO MIF-1
      I0=II-1:I1=II+1
      LOCATE 21,42:PRINT USING "M=###";II;

      IF UP(II,J1)=0 THEN UPIJ1=UP(II,J0) ELSE UPIJ1=UP(II,J1)
      IF UP(II,J0)=0 THEN UPIJ0=UP(II,J1) ELSE UPIJ0=UP(II,J0)
      AF=0.5:GM=0.5

      AUX=UP(II,JJ)-ATY4$(V(II,J0)+V(II,JJ)+V(I1,JJ)+V(I1,J0))_
        $((1-GM)$(UPIJ1-UP(II,JJ))+GM$(UP(II,JJ)-UPIJ0)) - _
        ATGRAVY$(HP(I1,JJ)-HP(II,JJ))

      U(II,JJ) = AUX/(1+ATX$((1-AF)$(UP(I1,JJ)-UP(II,JJ))+_
          AF$(UP(II,JJ)-UP(I0,JJ)))+AT86RAV$
          SQR(UP(II,JJ)^2+(V(II,J0)+V(II,JJ)+V(I1,JJ)+V(I1,J0))^2/16)/
          ((C(I1,JJ)+C(II,JJ))^2$(H(I1,JJ)+H(II,JJ)-Z(II,JJ)-Z(II,J0))))

    NEXT II
```

```
'..... condicao de contorno a jusante

   II=MIF:I0=II-1:I1=II+1
   C$=LEFT$(CO$(I1,JJ),1)
   LOCATE 21,42:PRINT USING "M=###";I1;

   IF C$<>"H" AND C$<>"U" THEN
      U(I1,JJ)=0
      U(II,JJ)=0'U(I0,JJ)/2
   ELSE
   NCONT=ASC(RIGHT$(CO$(I1,JJ),1))
      FOR LL=1 TO NPCON(NCONT)
         XX(LL)=XB(NCONT,LL):YY(LL)=CB(NCONT,LL)
      NEXT LL
      FUN=FNPINT(NPCON(NCONT),TEMPO)
   END IF
   IF C$="U" THEN
      U(I1,JJ)=FUN
      U(II,JJ)=(FUN+U(I0,JJ))/2
   END IF

   IF C$="H" THEN
      H(I1,JJ)=FUN
      IF UP(II,J1)=0 THEN UPIJ1=UP(II,J0) ELSE UPIJ1=UP(II,J1)
      IF UP(II,J0)=0 THEN UPIJ0=UP(II,J1) ELSE UPIJ0=UP(II,J0)
      AF=0:GM=0.5

      AUX=UP(II,JJ)-ATY4$(V(II,J0)+V(II,JJ))
         $((1-GM)$(UPIJ1-UP(II,JJ))+GM$(UP(II,JJ)-UPIJ0)) - _
         ATGRAVY$(HP(I1,JJ)-HP(II,JJ))

      U(II,JJ) = AUX/(1+ATX$(AF$(UP(II,JJ)-UP(I0,JJ)))+AT8GRAV$ _
          SQR(UP(II,JJ)^2+(V(II,J0)+V(II,JJ))^2/16)/
          ((C(I1,JJ)+C(II,JJ))^2$(H(I1,JJ)+H(II,JJ)-Z(II,JJ)-Z(II,J0))))

   END IF

NEXT NS


'.....Guarda Resultados no Arquivo Auxiliar
 KEY(3) OFF:KEY(5) OFF:KEY(9) OFF:KEY(10) OFF

 IF INT(TEMPO/FATOR+.1) MOD IOPS =0 THEN
    SOUND 512,1
    LOCATE 23,42,0:COLOR 23,0:PRINT "G R A V A N D O";:COLOR 7,0

    OPEN "R",#1,DRIVESPOOL$+"MDBDRES.AUX",10

    INCR RREG
    PREG=RREG
    NPG=0
    FIELD #1, 1 AS BM$,1 AS BN$,2 AS BU$,2 AS BV$,4 AS BH$
    FOR M=1 TO MMAX
       FOR N=1 TO NMAX
          C$=LEFT$(CO$(M,N),1)
          IF C$="T" OR C$="H" OR C$="U" OR C$="V" THEN
              LSET BM$=CHR$(M):LSET BN$=CHR$(N)
              LSET BU$=MKI$(INT(U(M,N)$100))
              LSET BV$=MKI$(INT(V(M,N)$100))
              LSET BH$=MKS$(H(M,N))
              INCR RREG
              PUT #1,RREG
              INCR NPG
          END IF
       NEXT N
    NEXT M
    FIELD #1,4 AS BTEMPO$,2 AS BNPG$, 4 AS BOP$
      LSET BTEMPO$=MKS$(TEMPO):LSET BNPG$=MKI$(NPG):LSET BOP$=""
      PUT #1,PREG
    CLOSE #1
    LOCATE 23,42:PRINT "                ";
 END IF
 ON KEY(3) GOSUB KEY3:KEY(3) ON
 ON KEY(5) GOSUB KEY5:KEY(5) ON
 ON KEY(10) GOSUB KEY10:KEY(10) ON
```

```
'.....TERMINO DO LOOP DE TEMPO
     LOOP UNTIL TEMPO >XBMAX
'.....................................................................
```

BATIMETRIA DO ARQUIVO: harvy - Cotas em m

YX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	YX
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	-3.8	54
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	-2.2	-4.1	53
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1	-3.3	-4.8	52
51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1	-1.7	-4.0	-5.2	51
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1	-2.3	-4.2	-5.3	50
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-0.9	-0.9	0.0	0.0	0.0	0.0	0.0	-1.3	-3.0	-4.3	-4.9	49
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	0.0	-1.3	-3.1	-4.2	-4.8	48
47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	0.0	-1.5	-3.3	-4.1	-4.6	47
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-0.9	-0.9	-0.9	-1.0	0.0	-1.4	-3.2	-4.0	-4.5	46
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.1	-1.5	-1.0	0.0	-1.4	-3.1	-4.0	-4.4	45
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.2	-1.5	-1.2	0.0	-1.0	-3.0	-4.2	-4.4	44
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.4	-1.6	-1.7	-1.0	-1.0	-2.8	-3.8	-4.1	43
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-0.9	-1.8	-1.5	-1.0	-1.0	-2.6	-3.6	-4.0	42
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.6	-1.9	-1.2	-1.0	-1.0	-2.5	-3.5	-4.0	41
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-3.0	-1.4	-1.0	-1.0	-1.0	-2.4	-3.5	-4.2	40
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-3.0	-1.0	-1.0	-1.0	-1.0	-2.5	-3.7	-4.5	39
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	-2.6	-2.0	-0.9	-1.1	-1.6	-2.7	-3.9	-5.0	38
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.9	-2.4	-2.8	-2.3	-2.3	-2.4	-3.8	-5.1	-4.1	37
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.8	-2.1	-2.7	-3.2	-3.4	-4.7	-4.7	-4.2	-2.6	36
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.9	-2.2	-2.6	-3.2	-3.7	-3.9	-3.9	-3.8	-3.3	35
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.8	-2.1	-2.9	-3.7	-4.4	-4.8	-4.4	-4.2	-4.2	34
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.0	-3.1	-4.5	-5.5	-5.3	-4.3	-4.2	-3.6	-3.3	33
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.4	-1.7	-4.3	-6.3	-6.6	-4.2	-2.4	-2.0	-1.8	-2.0	-2.0	32
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.4	-1.4	-2.6	-3.5	-3.9	-4.4	-5.2	-6.7	-7.0	-4.5	-2.2	-1.7	-2.1	-2.2	-2.5	-2.5	-2.5	31
30	0.0	0.0	0.0	0.0	0.0	-1.4	-1.4	-5.6	-7.5	-8.5	-8.3	-7.7	-7.2	-7.4	-6.6	-6.2	-5.0	-2.3	-1.4	-1.5	-1.7	-1.8	-2.0	-2.7	-2.9	-3.2	30
29	0.0	-1.4	-1.4	-5.6	-7.8	-9.8	-9.6	-8.9	-8.6	-8.3	-7.6	-7.9	-7.5	-8.1	-7.4	-6.2	-5.4	-2.2	-1.4	-2.1	-2.2	-2.5	-2.4	-2.4	-2.5	-3.0	29
28	-9.2	-10.7	-11.5	-10.6	-9.6	-8.7	-7.5	-6.5	-5.9	-5.6	-5.3	-5.0	-4.8	-4.6	-5.5	-7.2	-7.7	-7.1	-4.0	-3.0	-2.3	-2.5	-2.7	-2.8	-2.6	-2.7	28
27	-11.6	-10.7	-9.9	-9.5	-8.7	-7.7	-6.6	-5.7	-5.1	-4.4	-4.0	-3.3	-3.2	-2.9	-2.6	-3.7	-7.1	-7.0	-6.4	-6.0	-4.2	-3.4	-3.3	-3.3	-3.2	-2.6	27
26	-9.5	-11.5	-13.1	-10.5	-7.4	-6.5	-6.0	-5.5	-4.9	-4.9	-4.2	-2.6	-1.6	-2.9	-3.6	-3.6	-4.1	-5.6	-6.0	-5.5	-4.9	-4.5	-4.2	-4.0	-3.5	-3.0	26
25	-8.4	-7.7	-1.4	-9.0	-3.8	-3.9	-4.2	-4.8	-4.8	-4.0	-3.9	-4.8	-3.8	-2.0	-2.8	-4.3	-4.2	-4.5	-5.3	-5.5	-5.3	-4.3	-3.1	-2.6	-2.3	-3.2	25
24	0.0	0.0	0.0	-1.4	-5.0	-5.9	-5.3	-5.1	-4.9	-4.0	-3.7	-3.8	-4.6	-3.9	-3.0	-2.5	-4.2	-4.4	-4.6	-4.9	-5.5	-5.3	-4.7	-3.8	-3.3	-3.7	24
23	0.0	0.0	0.0	-1.4	-2.0	-3.5	-5.4	-6.7	-8.0	-7.5	-5.9	-4.1	-3.8	-4.0	-3.8	-2.5	-3.2	-4.2	-4.4	-4.3	-4.3	-4.6	-5.2	-5.0	-4.2	-3.6	23
22	0.0	0.0	0.0	-1.4	-1.4	-1.7	-2.4	-1.4	-1.5	-5.7	-8.7	-6.8	-5.3	-4.2	-3.4	-3.0	-2.4	-3.4	-4.0	-4.3	-4.2	-4.1	-4.2	-4.5	-5.1	-4.9	22
21	0.0	0.0	0.0	-3.3	-2.7	-2.0	-1.4	0.0	-1.4	-1.4	-6.5	-8.5	-7.3	-5.6	-4.9	-3.5	-2.4	-2.9	-3.6	-4.0	-4.1	-4.0	-4.0	-4.1	-4.3	-4.6	21
20	0.0	0.0	0.0	-1.5	-5.6	-1.5	-1.5	0.0	0.0	0.0	-1.4	-3.6	-7.8	-7.3	-5.7	-4.8	-4.0	-3.0	-3.3	-3.9	-4.0	-4.1	-3.9	-3.8	-3.9	-4.1	20
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.0	-7.6	-7.2	-5.5	-6.0	-4.4	-3.1	-3.5	-3.8	-4.0	-4.0	-4.0	-3.8	-3.9	19
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.7	-7.5	-6.5	-5.2	-4.9	-4.4	-3.3	-3.5	-3.7	-3.8	-3.9	-3.9	-3.9	18
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-4.7	-7.0	-5.9	-5.1	-4.7	-4.3	-3.7	-3.8	-3.8	-3.9	-3.9	-4.0	17
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-6.5	-6.4	-5.7	-5.0	-4.7	-4.2	-3.8	-4.0	-4.1	-4.1	-4.1	16
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-3.5	-6.5	-5.7	-5.2	-5.0	-4.7	-4.3	-4.0	-4.2	-4.3	-4.4	15
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.2	-6.4	-5.6	-5.1	-4.8	-4.7	-4.6	-4.4	-4.4	-4.5	-4.6	14
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-4.2	-5.9	-5.1	-4.8	-4.6	-4.5	-4.5	-4.5	-4.6	-4.9	13
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-5.8	-4.7	-4.7	-4.7	-4.6	-4.6	-4.6	-4.7	-4.9	12
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-4.6	-4.6	-4.0	-4.1	-4.4	-4.7	-4.8	-5.0	-5.1	11
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.5	-5.6	-3.8	-4.1	-4.2	-4.3	-4.5	-4.9	-5.5	10
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-5.2	-3.7	-4.1	-4.4	-4.5	-4.5	-4.7	-5.0	9
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.7	-4.2	-3.3	-4.2	-4.7	-4.9	-4.9	-5.2	8
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-1.5	-4.6	-3.3	-3.9	-4.6	-4.9	-5.2	-5.5	7
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.0	-4.4	-3.6	-4.4	-5.1	-5.3	-5.6	6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.0	-3.9	-4.3	-5.0	-5.5	-5.7	5
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-3.4	-4.0	-4.9	-5.5	-5.8	4
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-3.0	-3.7	-4.5	-5.3	-5.8	3
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.8	-4.1	-5.0	-5.7	2
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.4	-2.7	-4.2	-5.6	1

BATIMETRIA DO ARQUIVO: harvy - Cotas em m

YX	27	28	29	30	31	YX
55	0.0	-7.9	-7.8	-8.8	-8.8	55
54	-5.7	-7.9	-7.8	-8.8	-8.8	54
53	-5.8	-6.3	-6.6	-7.3	-7.3	53
52	-5.8	-6.0	-6.1	-6.8	-6.8	52
51	-5.8	-5.9	-6.2	-6.5	-6.5	51
50	-5.7	-5.9	-6.1	-6.5	-6.5	50
49	-5.5	-5.8	-6.0	-6.4	-6.4	49
48	-5.3	-5.7	-5.9	-6.3	-6.3	48
47	-5.2	-5.7	-5.9	-6.1	-6.1	47
46	-5.1	-5.5	-5.8	-6.3	-6.3	46
45	-4.9	-5.4	-5.8	-6.3	-6.3	45
44	-4.7	-5.2	-5.7	-6.3	-6.3	44
43	-4.4	-4.9	-5.4	-6.2	-6.2	43
42	-4.4	-4.6	-5.2	-6.1	-6.1	42
41	-4.2	-4.1	-4.8	-6.2	-6.2	41
40	-4.4	-3.7	-4.4	-6.0	-6.0	40
39	-4.2	-3.4	-4.2	-5.9	-5.9	39
38	-3.6	-3.0	-4.2	-6.0	-6.0	38
37	-2.5	-2.5	-3.9	-5.7	-5.7	37
36	-2.4	-2.4	-3.2	-5.3	-5.3	36
35	-2.9	-2.7	-2.7	-4.8	-4.8	35
34	-3.8	-3.3	-3.0	-4.4	-4.4	34
33	-3.5	-3.3	-3.2	-4.2	-4.2	33
32	-2.6	-3.0	-3.2	-5.0	-5.0	32
31	-2.7	-3.4	-4.1	-5.2	-5.2	31
30	-3.2	-3.6	-4.5	-5.6	-5.6	30
29	-3.1	-3.7	-4.6	-5.7	-5.7	29
28	-3.0	-3.5	-4.4	-5.5	-5.5	28
27	-2.7	-3.4	-4.2	-5.4	-5.4	27
26	-2.7	-3.2	-4.1	-5.1	-5.1	26
25	-3.1	-3.7	-4.1	-4.9	-4.9	25
24	-3.9	-4.0	-4.3	-5.0	-5.0	24
23	-3.8	-4.3	-4.4	-4.9	-4.9	23
22	-4.1	-4.2	-4.6	-5.0	-5.0	22
21	-4.3	-4.2	-4.7	-5.1	-5.1	21
20	-4.2	-4.4	-4.8	-5.2	-5.2	20
19	-4.1	-4.5	-4.9	-5.5	-5.5	19
18	-4.2	-4.6	-5.1	-5.5	-5.5	18
17	-4.3	-4.8	-5.2	-5.8	-5.8	17
16	-4.4	-4.8	-5.3	-5.8	-5.8	16
15	-4.6	-4.9	-5.3	-6.0	-6.0	15
14	-4.9	-5.2	-5.7	-6.2	-6.2	14
13	-5.1	-5.5	-5.9	-6.4	-6.4	13
12	-5.2	-5.6	-6.1	-6.7	-6.7	12
11	-5.5	-5.7	-6.1	-6.6	-6.6	11
10	-5.8	-6.1	-6.3	-6.8	-6.8	10
9	-5.7	-6.3	-6.8	-7.1	-7.1	9
8	-5.5	-5.9	-6.4	-7.1	-7.1	8
7	-5.9	-6.1	-6.5	-6.8	-6.8	7
6	-5.9	-6.3	-6.8	-7.1	-7.1	6
5	-6.0	-6.3	-6.7	-7.2	-7.2	5
4	-6.2	-6.4	-6.8	-7.2	-7.2	4
3	-6.3	-6.8	-6.9	-7.3	-7.3	3
2	-6.2	-6.7	-7.3	-7.6	-7.6	2
1	-6.1	-6.7	-7.1	-7.6	-7.6	1

RUGOSIDADES DO ARQUIVO: harvy - C (Chezy) em $m^{1/2}$ s^{-1}

YX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	YX
55	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	55
54	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0400	54
53	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0360	0.0520	53
52	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0430	0.0560	52
51	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0330	0.0470	0.0580	51
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0350	0.0510	0.0570	50
49	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0450	0.0550	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0350	0.0510	0.0570	49
48	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0450	0.0350	0.0350	0.0400	0.0400	0.0400	0.0000	0.0700	0.0420	0.0500	0.0530	48
47	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0700	0.0400	0.0400	0.0400	0.0410	0.0000	0.0700	0.0420	0.0500	0.0530	47
46	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0400	0.0450	0.0450	0.0000	0.0700	0.0420	0.0500	0.0530	46
45	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0350	0.0350	0.0350	0.0000	0.0700	0.0400	0.0510	0.0540	45
44	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0250	0.0350	0.0350	0.0000	0.0700	0.0400	0.0480	0.0520	44
43	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0250	0.0350	0.0350	0.0250	0.0700	0.0350	0.0490	0.0490	43
42	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0250	0.0350	0.0330	0.0250	0.0700	0.0350	0.0450	0.0490	42
41	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0410	0.0410	0.0330	0.0280	0.0700	0.0350	0.0470	0.0510	41
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0500	0.0470	0.0700	0.0700	0.0700	0.0350	0.0450	0.0510	40
39	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0410	0.0450	0.0220	0.0250	0.0250	0.0350	0.0480	0.0570	39
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0390	0.0430	0.0320	0.0320	0.0350	0.0430	0.0510	0.0600	38
37	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0320	0.0370	0.0420	0.0400	0.0400	0.0440	0.0530	0.0610	0.0550	37
36	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0380	0.0350	0.0390	0.0490	0.0570	0.0630	0.0640	0.0520	0.0440	36
35	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0350	0.0350	0.0400	0.0420	0.0540	0.0620	0.0620	0.0600	0.0570	35
34	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0330	0.0350	0.0450	0.0600	0.0630	0.0660	0.0620	0.0600	0.0580	34
33	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0350	0.0450	0.0590	0.0680	0.0650	0.0550	0.0400	0.0350	0.0380	33
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0550	0.0600	0.0660	0.0730	0.0700	0.0600	0.0360	0.0330	0.0350	0.0350	0.0340	32
31	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0550	0.0680	0.0750	0.0740	0.0740	0.0740	0.0730	0.0720	0.0720	0.0600	0.0250	0.0280	0.0310	0.0430	0.0430	0.0380	0.0400	31
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0710	0.0720	0.0690	0.0690	0.0720	0.0720	0.0700	0.0710	0.0680	0.0630	0.0480	0.0350	0.0250	0.0300	0.0350	0.0350	0.0350	0.0350	0.0410	0.0440	30
29	0.0000	0.0700	0.0550	0.0740	0.0730	0.0720	0.0690	0.0690	0.0670	0.0650	0.0620	0.0670	0.0670	0.0680	0.0730	0.0720	0.0720	0.0720	0.0350	0.0300	0.0330	0.0380	0.0430	0.0390	0.0420	0.0430	29
28	0.0800	0.0760	0.0740	0.0720	0.0710	0.0670	0.0660	0.0590	0.0590	0.0590	0.0570	0.0570	0.0530	0.0510	0.0490	0.0550	0.0730	0.0710	0.0710	0.0620	0.0490	0.0390	0.0440	0.0430	0.0410	0.0410	28
27	0.0710	0.0710	0.0730	0.0730	0.0680	0.0660	0.0660	0.0620	0.0600	0.0570	0.0520	0.0450	0.0350	0.0410	0.0410	0.0450	0.0600	0.0660	0.0690	0.0680	0.0660	0.0620	0.0520	0.0480	0.0490	0.0470	27
26	0.0710	0.0760	0.0800	0.0800	0.0630	0.0620	0.0670	0.0670	0.0590	0.0700	0.0600	0.0530	0.0430	0.0300	0.0500	0.0530	0.0530	0.0590	0.0670	0.0660	0.0630	0.0610	0.0500	0.0550	0.0450	0.0450	26
25	0.0700	0.0700	0.0700	0.0700	0.0600	0.0530	0.0380	0.0450	0.0580	0.0700	0.0480	0.0530	0.0580	0.0530	0.0350	0.0350	0.0540	0.0540	0.0610	0.0650	0.0570	0.0660	0.0610	0.0450	0.0430	0.0450	25
24	0.0000	0.0000	0.0000	0.0700	0.0420	0.0570	0.0630	0.0730	0.0730	0.0700	0.0500	0.0530	0.0450	0.0580	0.0520	0.0410	0.0360	0.0530	0.0560	0.0550	0.0560	0.0630	0.0660	0.0620	0.0550	0.0500	24
23	0.0000	0.0000	0.0000	0.0700	0.0420	0.0350	0.0410	0.0570	0.0500	0.0700	0.0740	0.0680	0.0570	0.0430	0.0460	0.0460	0.0380	0.0470	0.0530	0.0570	0.0530	0.0530	0.0550	0.0610	0.0630	0.0550	23
22	0.0000	0.0000	0.0000	0.0700	0.0530	0.0400	0.0530	0.0700	0.0700	0.0700	0.0740	0.0740	0.0710	0.0630	0.0530	0.0450	0.0420	0.0430	0.0510	0.0540	0.0550	0.0530	0.0530	0.0550	0.0590	0.0590	22
21	0.0000	0.0000	0.0000	0.0700	0.0350	0.0350	0.0350	0.0000	0.0700	0.0700	0.0700	0.0730	0.0730	0.0710	0.0630	0.0570	0.0450	0.0430	0.0520	0.0560	0.0530	0.0530	0.0520	0.0520	0.0520	0.0530	21
20	0.0000	0.0000	0.0000	0.0700	0.0700	0.0700	0.0700	0.0000	0.0000	0.0000	0.0700	0.0700	0.0650	0.0720	0.0730	0.0670	0.0590	0.0560	0.0470	0.0470	0.0480	0.0520	0.0510	0.0510	0.0510	0.0510	20
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0650	0.0720	0.0700	0.0600	0.0580	0.0570	0.0450	0.0480	0.0510	0.0510	0.0510	0.0510	0.0520	19
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0680	0.0720	0.0620	0.0600	0.0590	0.0570	0.0500	0.0510	0.0520	0.0520	0.0520	0.0520	18
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0720	0.0650	0.0610	0.0590	0.0580	0.0570	0.0620	0.0520	0.0520	0.0520	0.0530	17
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0720	0.0660	0.0630	0.0610	0.0590	0.0580	0.0560	0.0530	0.0530	0.0530	0.0530	16
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0640	0.0640	0.0620	0.0600	0.0690	0.0560	0.0560	0.0550	0.0550	0.0560	15
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0620	0.0610	0.0570	0.0500	0.0560	0.0560	0.0560	0.0570	0.0580	14
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0630	0.0630	0.0590	0.0580	0.0560	0.0560	0.0560	0.0560	0.0600	13
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0660	0.0660	0.0610	0.0550	0.0580	0.0570	0.0570	0.0570	0.0600	12
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0650	0.0670	0.0600	0.0530	0.0540	0.0540	0.0550	0.0580	0.0590	11
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0530	0.0630	0.0580	0.0530	0.0560	0.0560	0.0570	0.0590	10
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0500	0.0680	0.0510	0.0530	0.0570	0.0570	0.0570	0.0580	9
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0500	0.0600	0.0640	0.0560	0.0530	0.0580	0.0590	0.0600	8
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0500	0.0630	0.0650	0.0600	0.0530	0.0580	0.0590	7
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0530	0.0570	0.0570	0.0590	0.0590	0.0610	6
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0560	0.0560	0.0620	0.0550	0.0630	5
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0450	0.0550	0.0580	0.0490	0.0590	4
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0500	0.0580	0.0630	0.0600	3
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700	0.0490	0.0600	0.0650	2
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0450	0.0520	0.0620	1

RUGOSIDADES DO ARQUIVO: harvy - C (Chezy) em $m^{1/2} s^{-1}$

YX	27	28	29	30	31	YX
55	0.000	0.000	0.068	0.070	0.071	55
54	0.059	0.063	0.064	0.068	0.068	54
53	0.060	0.063	0.064	0.064	0.066	53
52	0.060	0.062	0.062	0.064	0.065	52
51	0.060	0.061	0.062	0.063	0.064	51
50	0.059	0.062	0.062	0.063	0.064	50
49	0.059	0.062	0.062	0.063	0.064	49
48	0.057	0.059	0.061	0.061	0.064	48
47	0.057	0.059	0.061	0.061	0.064	47
46	0.057	0.059	0.061	0.061	0.064	46
45	0.057	0.059	0.061	0.061	0.064	45
44	0.056	0.059	0.061	0.062	0.065	44
43	0.054	0.056	0.057	0.061	0.065	43
42	0.052	0.055	0.057	0.062	0.065	42
41	0.054	0.053	0.056	0.062	0.065	41
40	0.057	0.051	0.051	0.061	0.063	40
39	0.059	0.050	0.048	0.059	0.065	39
38	0.055	0.043	0.051	0.059	0.064	38
37	0.037	0.039	0.042	0.059	0.064	37
36	0.037	0.039	0.041	0.055	0.033	36
35	0.052	0.047	0.043	0.045	0.032	35
34	0.053	0.050	0.048	0.048	0.063	34
33	0.043	0.045	0.048	0.047	0.063	33
32	0.036	0.043	0.049	0.055	0.063	32
31	0.043	0.045	0.051	0.058	0.063	31
30	0.045	0.047	0.053	0.059	0.063	30
29	0.045	0.047	0.053	0.059	0.063	29
28	0.040	0.046	0.049	0.058	0.062	28
27	0.041	0.045	0.052	0.056	0.062	27
26	0.044	0.044	0.051	0.056	0.061	26
25	0.051	0.049	0.053	0.057	0.060	25
24	0.053	0.054	0.054	0.057	0.060	24
23	0.049	0.052	0.055	0.058	0.062	23
22	0.057	0.055	0.055	0.059	0.060	22
21	0.053	0.054	0.055	0.058	0.061	21
20	0.052	0.054	0.058	0.059	0.062	20
19	0.053	0.053	0.057	0.059	0.062	19
18	0.056	0.056	0.057	0.060	0.058	18
17	0.056	0.056	0.059	0.062	0.063	17
16	0.053	0.056	0.058	0.061	0.063	16
15	0.057	0.057	0.060	0.061	0.064	15
14	0.058	0.058	0.061	0.063	0.065	14
13	0.059	0.055	0.061	0.063	0.066	13
12	0.060	0.062	0.063	0.064	0.067	12
11	0.060	0.061	0.063	0.065	0.066	11
10	0.061	0.062	0.064	0.066	0.067	10
9	0.060	0.061	0.063	0.066	0.067	9
8	0.060	0.061	0.063	0.065	0.067	8
7	0.061	0.061	0.063	0.067	0.067	7
6	0.062	0.062	0.065	0.065	0.067	6
5	0.061	0.063	0.066	0.066	0.067	5
4	0.062	0.063	0.066	0.066	0.067	4
3	0.063	0.064	0.066	0.066	0.067	3
2	0.062	0.065	0.066	0.066	0.067	2
1	0.062	0.064	0.066	0.066	0.067	1

HIDRODINÂMICA BIDIMENSIONAL
ESTUDO EM MODELO MATEMÁTICO

ERRATA

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LEIA-SE :	$\lambda \rightarrow$ Variável Auxiliar = $e^{\beta_n \Delta t i} - 1$	
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LEIA-SE :	Efeito do Termo de Atrito	
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LEIA-SE :	.campo de velocidade detalhado podem ser muito úteis	
ONDE SE LÊ:	...como também a condição....	PAG. 2
LEIA-SE :	...como também a condição....	
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LEIA-SE :	...equações	
ONDE SE LÊ:	...admitindo também esta tensão	PAG. 13
LEIA-SE :	...admitindo também que esta tensão	
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LEIA-SE :	...observa-se o efeito...	
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LEIA-SE :	...c $\frac{\partial}{\partial x}\left(\Sigma\ U_n e^{[\alpha_n \Delta x + \beta_n \Delta t]i}\right)$	
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LEIA-SE :	...que, a não obediência da relação...	
ONDE SE LÊ:	... $\frac{1}{2\Delta t}\left(U_{i+1}^{t+1} - U_{i+1}^{t} + U_{i}^{t+1} + U_{i}^{t}\right)$	PAG. 73
LEIA-SE :	... $\frac{1}{2\Delta t}\left(U_{i+1}^{t+1} - U_{i+1}^{t} + U_{i}^{t+1} - U_{i}^{t}\right)$	
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LEIA-SE :	...matriz dos coeficientes é...	
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LEIA-SE :	...natureza da aplicação e o metodo...	
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LEIA-SE :	...onde se pode adotar...	
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