

AA02 - Métodos Numéricos Computacionais

Guilherme Brizzi

1 Pivotamento Parcial

$$A_0 = \begin{bmatrix} 14 & -26 & -6 & -33 & 4 & -69 & 45 & -74 \\ -21 & -2 & -14 & 47 & 66 & 97 & 91 & 68 \\ -64 & 27 & -55 & -73 & -72 & -32 & 75 & -97 \\ 22 & -96 & 70 & 85 & 36 & -37 & -84 & 90 \\ -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ -30 & 76 & 81 & -67 & 29 & -52 & 34 & -26 \\ 19 & -51 & 17 & -78 & -30 & -100 & 59 & 6 \end{bmatrix}$$

$$A_1 = \begin{bmatrix} -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ 0 & -21.82022472 & -11.64044944 & 36.14606742 & 64.58426966 & 112.8089888 & 80.61797753 & 65.16853933 \\ 0 & -33.40449438 & -47.80898876 & -106.0786517 & -76.31460674 & 16.17977528 & 43.35955056 & -105.6292135 \\ 0 & -75.23595506 & 67.52808989 & 96.37078652 & 37.48314607 & -53.56179775 & -73.12359551 & 92.96629213 \\ 0 & -12.78651685 & -7.573033708 & -25.76404494 & 4.943820225 & -79.53932584 & 51.92134831 & -72.11235955 \\ 0 & 47.68539326 & 84.37078652 & -82.50561798 & 26.97752809 & -29.41573034 & 19.16853933 & -30.04494382 \\ 0 & -33.06741573 & 14.86516854 & -68.17977528 & -28.71910112 & -114.3033708 & 68.39325843 & 8.561797753 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ 0 & -75.23595506 & 67.52808989 & 96.37078652 & 37.48314607 & -53.56179775 & -73.12359551 & 92.96629213 \\ 0 & 0 & -77.79121864 & -148.8669355 & -92.95698925 & 39.96102151 & 75.82616487 & -146.905914 \\ 0 & 0 & -31.22520908 & 8.196236559 & 53.71326165 & 128.34319 & 101.8255675 & 38.20609319 \\ 0 & 0 & -19.04958184 & -42.14247312 & -1.426523297 & -70.43637993 & 64.34886499 & -87.91218638 \\ 0 & 0 & 127.1708483 & -21.42473118 & 50.73476703 & -63.36379928 & -27.17801673 & 28.8781362 \\ 0 & 0 & -14.81451613 & -110.5362903 & -45.19354839 & -90.76209677 & 100.5322581 & -32.2983871 \end{bmatrix}$$

$$A_3 = \begin{bmatrix} -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ 0 & -75.23595506 & 67.52808989 & 96.37078652 & 37.48314607 & -53.56179775 & -73.12359551 & 92.96629213 \\ 0 & 0 & 127.1708483 & -21.42473118 & 50.73476703 & -63.36379928 & -27.17801673 & 28.8781362 \\ 0 & 0 & 0 & 2.935662145 & 66.17054828 & 112.7850026 & 95.15234588 & 45.29675786 \\ 0 & 0 & 0 & -45.35179487 & 6.173300953 & -79.92797251 & 60.27772872 & -83.58638038 \\ 0 & 0 & 0 & -161.9725801 & -61.92220881 & 1.20098152 & 59.20119877 & -129.240974 \\ 0 & 0 & 0 & -113.032122 & -39.28330217 & -98.14353709 & 97.36620883 & -28.93428581 \end{bmatrix}$$

$$A_4 = \begin{bmatrix} -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ 0 & -75.23595506 & 67.52808989 & 96.37078652 & 37.48314607 & -53.56179775 & -73.12359551 & 92.96629213 \\ 0 & 0 & 127.1708483 & -21.42473118 & 50.73476703 & -63.36379928 & -27.17801673 & 28.8781362 \\ 0 & 0 & 0 & -161.9725801 & -61.92220881 & 1.20098152 & 59.20119877 & -129.240974 \\ 0 & 0 & 0 & 0 & 23.51131773 & -80.26424342 & 43.70158588 & -47.39932862 \\ 0 & 0 & 0 & 0 & 65.04824298 & 112.8067697 & 96.22533439 & 42.95433771 \\ 0 & 0 & 0 & 0 & 3.928941848 & -98.98163876 & 56.05281421 & 61.25617431 \end{bmatrix}$$

$$A_5 = \begin{bmatrix} -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ 0 & -75.23595506 & 67.52808989 & 96.37078652 & 37.48314607 & -53.56179775 & -73.12359551 & 92.96629213 \\ 0 & 0 & 127.1708483 & -21.42473118 & 50.73476703 & -63.36379928 & -27.17801673 & 28.8781362 \\ 0 & 0 & 0 & -161.9725801 & -61.92220881 & 1.20098152 & 59.20119877 & -129.240974 \\ 0 & 0 & 0 & 0 & 65.04824298 & 112.8067697 & 96.22533439 & 42.95433771 \\ 0 & 0 & 0 & 0 & 0 & -121.0376092 & 8.921485657 & -62.92492986 \\ 0 & 0 & 0 & 0 & 0 & -105.7952162 & 50.24076264 & 58.66171385 \end{bmatrix}$$

$$A_6 = \begin{bmatrix} -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ 0 & -75.23595506 & 67.52808989 & 96.37078652 & 37.48314607 & -53.56179775 & -73.12359551 & 92.96629213 \\ 0 & 0 & 127.1708483 & -21.42473118 & 50.73476703 & -63.36379928 & -27.17801673 & 28.8781362 \\ 0 & 0 & 0 & -161.9725801 & -61.92220881 & 1.20098152 & 59.20119877 & -129.240974 \\ 0 & 0 & 0 & 0 & 65.04824298 & 112.8067697 & 96.22533439 & 42.95433771 \\ 0 & 0 & 0 & 0 & 0 & -121.0376092 & 8.921485657 & -62.92492986 \\ 0 & 0 & 0 & 0 & 0 & 0 & 42.44276903 & 113.6624413 \end{bmatrix}$$

$x_7 = 2.67801663;$
 $x_6 = 0.7172714115;$
 $x_5 = -4.545115525;$
 $x_4 = 3.51965617;$
 $x_3 = 3.563029023;$
 $x_2 = 1.092835269;$
 $x_1 = 2.792998991;$

2 Pivotamento Total

$$A_0 = \begin{bmatrix} 14 & -26 & -6 & -33 & 4 & -69 & 45 & -74 \\ -21 & -2 & -14 & 47 & 66 & 97 & 91 & 68 \\ -64 & 27 & -55 & -73 & -72 & -32 & 75 & -97 \\ 22 & -96 & 70 & 85 & 36 & -37 & -84 & 90 \\ -89 & 84 & -10 & 46 & 6 & -67 & 44 & 12 \\ -30 & 76 & 81 & -67 & 29 & -52 & 34 & -26 \\ 19 & -51 & 17 & -78 & -30 & -100 & 59 & 6 \end{bmatrix}$$

$$A_1 = \begin{bmatrix} -100 & -51 & 17 & -78 & -30 & 19 & 59 & 6 \\ 0 & -51.47 & 2.49 & -28.66 & 36.9 & -2.57 & 148.23 & 73.82 \\ 0 & 43.32 & -60.44 & -48.04 & -62.4 & -70.08 & 56.12 & -98.92 \\ 0 & -77.13 & 63.71 & 113.86 & 47.1 & 14.97 & -105.83 & 87.78 \\ 0 & 118.17 & -21.39 & 98.26 & 26.1 & -101.73 & 4.47 & 7.98 \\ 0 & 102.52 & 72.16 & -26.44 & 44.6 & -39.88 & 3.32 & -29.12 \\ 0 & 9.19 & -17.73 & 20.82 & 24.7 & 0.89 & 4.29 & -78.14 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} -100 & 59 & 17 & -78 & -30 & 19 & -51 & 6 \\ 0 & 148.23 & 2.49 & -28.66 & 36.9 & -2.57 & -51.47 & 73.82 \\ 0 & 0 & -61.38271605 & -37.18930041 & -76.37037037 & -69.10699588 & 62.80658436 & -126.8683128 \\ 0 & 0 & 65.48775552 & 93.39796263 & 73.44505161 & 13.13512784 & -113.8774202 & 140.4843824 \\ 0 & 0 & -21.46508804 & 99.12426634 & 24.98724954 & -101.6524995 & 119.722121 & 5.753895972 \\ 0 & 0 & 72.10422991 & -25.79808406 & 43.77352763 & -39.8224381 & 103.6728058 & -30.7733927 \\ 0 & 0 & -17.80206436 & 21.64946367 & 23.63205829 & 0.9643796802 & 10.67961951 & -80.27646225 \end{bmatrix}$$

$$A_3 = \begin{bmatrix} -100 & 59 & -51 & -78 & -30 & 19 & 17 & 6 \\ 0 & 148.23 & -51.47 & -28.66 & 36.9 & -2.57 & 2.49 & 73.82 \\ 0 & 0 & 119.722121 & 99.12426634 & 24.98724954 & -101.6524995 & -21.46508804 & 5.753895972 \\ 0 & 0 & 0 & 187.6830925 & 97.21245142 & -83.55480968 & 45.0705692 & 145.9573795 \\ 0 & 0 & 0 & -89.19018833 & -89.47875655 & -15.77978926 & -50.12206638 & -129.8868239 \\ 0 & 0 & 0 & -111.6342748 & 22.13593679 & 48.20306417 & 90.69182161 & -35.75595177 \\ 0 & 0 & 0 & 12.8072427 & 21.40311083 & 10.03212762 & -15.88730566 & -80.7897293 \end{bmatrix}$$

$$A_4 = \begin{bmatrix} -100 & 59 & -51 & -78 & -30 & 19 & 17 & 6 \\ 0 & 148.23 & -51.47 & -28.66 & 36.9 & -2.57 & 2.49 & 73.82 \\ 0 & 0 & 119.722121 & 99.12426634 & 24.98724954 & -101.6524995 & -21.46508804 & 5.753895972 \\ 0 & 0 & 0 & 187.6830925 & 97.21245142 & -83.55480968 & 45.0705692 & 145.9573795 \\ 0 & 0 & 0 & 0 & -43.28175109 & -55.48645176 & -28.70376758 & -60.52540194 \\ 0 & 0 & 0 & 0 & 79.95809523 & -1.49550194 & 117.4998853 & 51.05978636 \\ 0 & 0 & 0 & 0 & 14.76946342 & 15.73379586 & -18.9628609 & -90.74966527 \end{bmatrix}$$

$$A_5 = \begin{bmatrix} -100 & 59 & -51 & -78 & 17 & 19 & -30 & 6 \\ 0 & 148.23 & -51.47 & -28.66 & 2.49 & -2.57 & 36.9 & 73.82 \\ 0 & 0 & 119.722121 & 99.12426634 & -21.46508804 & -101.6524995 & 24.98724954 & 5.753895972 \\ 0 & 0 & 0 & 187.6830925 & 45.0705692 & -83.55480968 & 97.21245142 & 145.9573795 \\ 0 & 0 & 0 & 0 & 117.4998853 & -1.49550194 & 79.95809523 & 51.05978636 \\ 0 & 0 & 0 & 0 & 0 & -55.85178437 & -23.74897815 & -48.05212815 \\ 0 & 0 & 0 & 0 & 0 & 15.49244247 & 27.67359719 & -82.50931999 \end{bmatrix}$$

$$A_6 = \begin{bmatrix} -100 & 59 & -51 & -78 & 17 & 19 & -30 & 6 \\ 0 & 148.23 & -51.47 & -28.66 & 2.49 & -2.57 & 36.9 & 73.82 \\ 0 & 0 & 119.722121 & 99.12426634 & -21.46508804 & -101.6524995 & 24.98724954 & 5.753895972 \\ 0 & 0 & 0 & 187.6830925 & 45.0705692 & -83.55480968 & 97.21245142 & 145.9573795 \\ 0 & 0 & 0 & 0 & 117.4998853 & -1.49550194 & 79.95809523 & 51.05978636 \\ 0 & 0 & 0 & 0 & 0 & -55.85178437 & -23.74897815 & -48.05212815 \\ 0 & 0 & 0 & 0 & 0 & 0 & 21.0859889 & -95.83825548 \end{bmatrix}$$

$x_7 = 2.67801663;$
 $x_6 = 0.7172714115;$
 $x_5 = -4.545115525;$
 $x_4 = 3.51965617;$
 $x_3 = 3.563029023;$
 $x_2 = 1.092835269;$
 $x_1 = 2.792998991;$

3 Jacobi

k	$x_{1,k}$	$x_{2,k}$	$x_{3,k}$	$x_{4,k}$	$x_{5,k}$	$x_{6,k}$	$x_{7,k}$
0	0	0	0	0	0	0	0
1	0.03425414365	-0.08961748634	-0.02460629921	-0.04513888889	-0.04949381327	-0.004400440044	-0.1226295828
2	0.05938036097	-0.05580863194	-0.04850079067	-0.08397763016	-0.05305383048	-0.02269732314	-0.1348681961
3	0.0524787275	-0.04114544944	-0.0388753835	-0.06929515605	-0.03962499214	-0.02765316476	-0.136947726
4	0.04863592452	-0.04451001111	-0.03256055791	-0.0624714705	-0.0451621755	-0.02140536188	-0.1350858307
5	0.04876853095	-0.04731758669	-0.03413434823	-0.06426678509	-0.04775016241	-0.02256879981	-0.135609265
6	0.04960780531	-0.04666880032	-0.03523175215	-0.06528870779	-0.04713546559	-0.02358451644	-0.1363354316
7	0.04958349758	-0.04615855649	-0.03494660424	-0.06496293608	-0.04680485899	-0.02344724991	-0.1363267058
8	0.04943372858	-0.04625734381	-0.03475524054	-0.06477045	-0.04692795459	-0.02330313468	-0.1362390522
9	0.04943686497	-0.04634128384	-0.0347990517	-0.06481751639	-0.04699546671	-0.02332797845	-0.1362501825
10	0.0494616472	-0.04632510933	-0.03483107147	-0.06484885106	-0.04697905492	-0.02335455346	-0.1362683183
11	0.0494613749	-0.04631056712	-0.03482400259	-0.06484084307	-0.04696853434	-0.02335143298	-0.1362678669
12	0.04945720099	-0.04631298858	-0.03481847218	-0.06483529825	-0.04697149689	-0.02334712734	-0.1362651918
13	0.04945717919	-0.04631543463	-0.03481956042	-0.06483650593	-0.04697341836	-0.02334766153	-0.1362653525
14	0.04945787665	-0.04631505341	-0.03482049695	-0.06483743365	-0.04697298601	-0.02334841401	-0.1362658443
15	0.04945788924	-0.04631463471	-0.03482032527	-0.06483723765	-0.04697267018	-0.02334834229	-0.1362658375

k	$ER_{1,k}$	$ER_{2,k}$	$ER_{3,k}$	$ER_{4,k}$	$ER_{5,k}$	$ER_{6,k}$	$ER_{7,k}$
0	-	-	-	-	-	-	-
1	1	1	1	1	1	1	1
2	0.4231401917	0.6057997342	0.4926618953	0.4624891319	0.06710198251	0.8061251533	0.09074499127
3	0.131512973	0.3563743427	0.2475964557	0.2118831235	0.3388981957	0.1792142656	0.01518484461
4	0.07901161574	0.07559112174	0.1939409517	0.1092288287	0.122606657	0.2918802733	0.01378305384
5	0.002719098317	0.05933471618	0.04610576742	0.0279353415	0.05419849447	0.05155072199	0.00385987075
6	0.01691819159	0.01390192935	0.03114815045	0.01565236521	0.01304106806	0.04306709609	0.005326323227
7	0.0004902381885	0.01105415492	0.008159531126	0.005014731937	0.00706351037	0.005854269901	6.400618329e-05
8	0.003029692513	0.002135603122	0.005506038733	0.002971819342	0.002623076305	0.006184371024	0.0006433809859
9	6.344231735e-05	0.001811344372	0.001258975847	0.0007261369519	0.001436566528	0.001064977532	8.169022447e-05
10	0.0005010392298	0.0003491520029	0.000919287295	0.0004831954237	0.0003493425907	0.001137894134	0.0001330890482
11	5.505254751e-06	0.0003140149324	0.000202988659	0.0001235022191	0.0002239920927	0.0001336313382	3.312563159e-06
12	8.439436105e-05	5.228466737e-05	0.0001588353989	8.552163826e-05	6.307123123e-05	0.0001844183844	1.963207376e-05
13	4.407799333e-07	5.281276165e-05	3.125371253e-05	1.862646335e-05	4.090541767e-05	2.287959779e-05	1.179963771e-06
14	1.410195371e-05	8.231012492e-06	2.68958195e-05	1.430849401e-05	9.204258362e-06	3.222843285e-05	3.608774829e-06
15	2.546364245e-07	9.040265242e-06	4.930557828e-06	3.022989697e-06	6.723566044e-06	3.071890621e-06	4.989868997e-08

4 Gauss-Seidel

k	$x_{1,k}$	$x_{2,k}$	$x_{3,k}$	$x_{4,k}$	$x_{5,k}$	$x_{6,k}$	$x_{7,k}$
0	0	0	0	0	0	0	0
1	0.03425414365	-0.08853183588	-0.05171701111	-0.08543146605	-0.01871032979	-0.02221107805	-0.1284322027
2	0.06116266214	-0.04152557772	-0.03151701588	-0.06610259076	-0.04548439852	-0.02356205546	-0.1363333464
3	0.04768884742	-0.04603994551	-0.0345553105	-0.06439995782	-0.04713898788	-0.02333904521	-0.1362498303
4	0.04937783733	-0.04643976874	-0.03486873008	-0.06487071402	-0.04695779166	-0.02334804047	-0.1362587911
5	0.04949406131	-0.04630527737	-0.03481754335	-0.06484091432	-0.04697043876	-0.02334847502	-0.136266454
6	0.04945478093	-0.04631372873	-0.03481959648	-0.06483613199	-0.04697324372	-0.0233482276	-0.1362657924
7	0.04945750464	-0.04631502331	-0.03482032241	-0.06483717655	-0.04697276381	-0.02334824398	-0.1362657576
8	0.0494578687	-0.04631473002	-0.03482020848	-0.06483713737	-0.04697277433	-0.02334824614	-0.1362657739

k	$ER_{1,k}$	$ER_{2,k}$	$ER_{3,k}$	$ER_{4,k}$	$ER_{5,k}$	$ER_{6,k}$	$ER_{7,k}$
0	-	-	-	-	-	-	-
1	1	1	1	1	1	1	1
2	0.4399500864	1.131983244	0.6409234717	0.2924072276	0.5886429105	0.05733699306	0.05795459404
3	0.2825359691	0.09805328261	0.0879255482	0.02643841697	0.03510023084	0.009555243163	0.0006129630127
4	0.03420542511	0.008609500984	0.008988557384	0.007256837038	0.003858703918	0.0003852681911	6.576280575e-05
5	0.002348240722	0.002904450228	0.001470141899	0.0004595817509	0.000269256394	1.861157244e-05	5.623513908e-05
6	0.0007942684922	0.0001824807239	5.896491911e-05	7.376027752e-05	5.971399563e-05	1.05971135e-05	4.855706183e-06
7	5.507169413e-05	2.795169074e-05	2.084787178e-05	1.611047164e-05	1.021659801e-05	7.018259948e-07	2.548755353e-07
8	7.360960319e-06	6.332575221e-06	3.271911156e-06	6.042837323e-07	2.239045223e-07	9.228340311e-08	1.193585267e-07