Computational and Numerical Methods

Group 16

Set 10 (08-10-2018): The Jacobi Iteration Method and the Gauss-Seidel Method

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Show Code

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Jacobian Method:

System of equations:
[  9*x1 +   1*x2 +   1*x3] = [ 10]
[  2*x1 +  10*x2 +   3*x3] = [ 19]
[  3*x1 +   4*x2 +  11*x3] = [  0]

Iteration 0: [0. 0. 0.]
Iteration 1: [1.11111111 1.9        0.        ]
Iteration 2: [ 0.9        1.67777778 -0.99393939]
Iteration 3: [ 1.03512907  2.01818182 -0.85555556]
Iteration 4: [ 0.98193042  1.94964085 -1.01619223]
Iteration 5: [ 1.0073946   2.00847158 -0.97675951]
Iteration 6: [ 0.99647644  1.99154893 -1.00509728]
Iteration 7: [ 1.00150537  2.0022339  -0.99596591]
Iteration 8: [ 0.99930356  1.9984887  -1.00122288]
Iteration 9: [ 1.0003038   2.00050615 -0.9992605 ]
Iteration 10: [ 0.99986159  1.99971739 -1.00026691]
Iteration 11: [ 1.00006106  2.00010775 -0.99985949]
Iteration 12: [ 0.99997241  1.99994563 -1.00005584]
Iteration 13: [ 1.00001224  2.00002227 -0.99997271]
Iteration 14: [ 0.99999449  1.99998936 -1.00001144]
Iteration 15: [ 1.00000245  2.00000453 -0.99999463]
Iteration 16: [ 0.9999989   1.9999979  -1.00000232]
Iteration 17: [ 1.00000049  2.00000092 -0.99999894]
Iteration 18: [ 0.99999978  1.99999958 -1.00000047]
Iteration 19: [ 1.0000001   2.00000018 -0.99999979]
Iteration 20: [ 0.99999996  1.99999992 -1.00000009]
Iteration 21: [ 1.00000002  2.00000004 -0.99999996]
Iteration 22: [ 0.99999999  1.99999998 -1.00000002]
Iteration 23: [ 1.          2.00000001 -0.99999999]
Iteration 24: [ 1.  2. -1.]
Analytic Solution: [ 1.  2. -1.]


Gauss-Seidel:

Iteration 1: [0. 0. 0.]
Iteration 2: [ 1.11111111  1.67777778 -0.91313131]
Iteration 3: [ 1.02615039  1.96870932 -0.99575349]
Iteration 4: [ 1.00300491  1.99812507 -1.00013773]
Iteration 5: [ 1.00022363  1.99999659 -1.00005975]
Iteration 6: [ 1.00000702  2.00001652 -1.00000792]
Iteration 7: [ 0.99999904  2.00000257 -1.00000067]
Iteration 8: [ 0.99999979  2.00000024 -1.00000003]
Iteration 9: [ 0.99999998  2.00000001 -1.        ]
Iteration 10: [ 1.  2. -1.]
Analytic Solution: [ 1.  2. -1.]
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Jacobian Method:

System of equations:
[  9*x1 +   1*x2 +   1*x3] = [ 10]
[  2*x1 +  10*x2 +   3*x3] = [ 19]
[  3*x1 +   4*x2 +  11*x3] = [  0]

Iteration 0: [100. 100. 100.]
Iteration 1: [-21.11111111 -48.1        -63.63636364]
Iteration 2: [13.52626263 25.21313131 23.24848485]
Iteration 3: [ -4.27351291  -7.77979798 -12.8573921 ]
Iteration 4: [3.40413223 6.61192021 3.99452097]
Iteration 5: [-0.06738235  0.02081726 -3.33273432]
Iteration 6: [1.4791019  2.91329677 0.01080709]
Iteration 7: [ 0.78621068  1.60093749 -1.46277207]
Iteration 8: [ 1.0957594   2.18158948 -0.79658018]
Iteration 9: [ 0.95722119  1.91982218 -1.09214874]
Iteration 10: [ 1.0191474   2.03620038 -0.95917748]
Iteration 11: [ 0.9914419   1.98392376 -1.01838579]
Iteration 12: [ 1.00382911  2.00722736 -0.99182007]
Iteration 13: [ 0.99828808  1.9967802  -1.00367243]
Iteration 14: [ 1.0007658   2.00144411 -0.99836228]
Iteration 15: [ 0.99965757  1.99935552 -1.00073399]
Iteration 16: [ 1.00015316  2.00028868 -0.99967226]
Iteration 17: [ 0.99993151  1.99987104 -1.00014675]
Iteration 18: [ 1.00003063  2.00005772 -0.99993443]
Iteration 19: [ 0.9999863   1.9999742  -1.00002934]
Iteration 20: [ 1.00000613  2.00001154 -0.99998688]
Iteration 21: [ 0.99999726  1.99999484 -1.00000587]
Iteration 22: [ 1.00000123  2.00000231 -0.99999738]
Iteration 23: [ 0.99999945  1.99999897 -1.00000117]
Iteration 24: [ 1.00000025  2.00000046 -0.99999948]
Iteration 25: [ 0.99999989  1.99999979 -1.00000023]
Iteration 26: [ 1.00000005  2.00000009 -0.9999999 ]
Iteration 27: [ 0.99999998  1.99999996 -1.00000005]
Iteration 28: [ 1.00000001  2.00000002 -0.99999998]
Iteration 29: [ 1.          1.99999999 -1.00000001]
Iteration 30: [ 1.  2. -1.]
Analytic Solution: [ 1.  2. -1.]


Gauss-Seidel:

Iteration 1: [100. 100. 100.]
Iteration 2: [-21.11111111 -23.87777778  14.44040404]
Iteration 3: [ 2.15970819 -2.86406285  0.45246607]
Iteration 4: [ 1.37906631  1.48844692 -0.91736242]
Iteration 5: [ 1.04765728  1.96567727 -1.00051645]
Iteration 6: [ 1.00387102  1.99938073 -1.00083054]
Iteration 7: [ 1.00016109  2.00021694 -1.00012282]
Iteration 8: [ 0.99998954  2.00003894 -1.00001131]
Iteration 9: [ 0.99999693  2.00000401 -1.00000062]
Iteration 10: [ 0.99999962  2.00000026 -0.99999999]
Iteration 11: [ 0.99999997  2.         -0.99999999]
Iteration 12: [ 1.  2. -1.]
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Jacobian Method:

System of equations:
[  9*x1 +   1*x2 +   1*x3] = [ 10]
[  2*x1 +  10*x2 +   3*x3] = [ 19]
[  3*x1 +   4*x2 +  11*x3] = [  0]

Iteration 0: [10000. 10000. 10000.]
Iteration 1: [-2221.11111111 -4998.1        -6363.63636364]
Iteration 2: [1263.52626263 2355.21313131 2423.24848485]
Iteration 3: [ -529.82906846  -977.77979798 -1201.03921028]
Iteration 4: [243.20211203 468.17757678 500.05512703]
Iteration 5: [-106.47030042 -196.75696051 -236.57424029]
Iteration 6: [ 49.25902231  94.16633217 100.5853403 ]
Iteration 7: [-20.52796361 -38.12740655 -47.67658142]
Iteration 8: [10.64488755 20.30856715 19.463047  ]
Iteration 9: [ -3.30795713  -6.06789161 -10.28808466]
Iteration 10: [2.92844181 5.64801682 3.10867617]
Iteration 11: [ 0.13814522  0.38170879 -2.85249025]
Iteration 12: [ 1.38564238  2.72811803 -0.17647917]
Iteration 13: [ 0.82759568  1.67581527 -1.36994539]
Iteration 14: [ 1.07712557  2.14546448 -0.83509529]
Iteration 15: [ 0.96551453  1.93510347 -1.07393042]
Iteration 16: [ 1.01542522  2.02907622 -0.96699614]
Iteration 17: [ 0.99310221  1.9870138  -1.01478005]
Iteration 18: [ 1.00308514  2.00581357 -0.99339653]
Iteration 19: [ 0.99862033  1.99740193 -1.00295543]
Iteration 20: [ 1.00061706  2.00116256 -0.99867897]
Iteration 21: [ 0.99972405  1.99948028 -1.00059104]
Iteration 22: [ 1.00012342  2.0002325  -0.99973575]
Iteration 23: [ 0.99994481  1.99989604 -1.00011821]
Iteration 24: [ 1.00002468  2.0000465  -0.99994714]
Iteration 25: [ 0.99998896  1.99997921 -1.00002364]
Iteration 26: [ 1.00000494  2.0000093  -0.99998943]
Iteration 27: [ 0.99999779  1.99999584 -1.00000473]
Iteration 28: [ 1.00000099  2.00000186 -0.99999789]
Iteration 29: [ 0.99999956  1.99999917 -1.00000095]
Iteration 30: [ 1.0000002   2.00000037 -0.99999958]
Iteration 31: [ 0.99999991  1.99999983 -1.00000019]
Iteration 32: [ 1.00000004  2.00000007 -0.99999992]
Iteration 33: [ 0.99999998  1.99999997 -1.00000004]
Iteration 34: [ 1.00000001  2.00000001 -0.99999998]
Iteration 35: [ 1.          1.99999999 -1.00000001]
Iteration 36: [ 1.  2. -1.]
Analytic Solution: [ 1.  2. -1.]


Gauss-Seidel:

Iteration 1: [10000. 10000. 10000.]
Iteration 2: [-2221.11111111 -2553.87777778  1534.44040404]
Iteration 3: [ 114.38193042 -481.3085073   143.82620345]
Iteration 4: [ 38.60914487 -48.96969001   7.27739322]
Iteration 5: [ 5.74358853 -1.43193567 -1.04572936]
Iteration 6: [ 1.38640723  1.93643736 -1.0822701 ]
Iteration 7: [ 1.01620364  2.0214403  -1.01221565]
Iteration 8: [ 0.99897504  2.00386969 -1.00112762]
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Iteration 9: [ 0.99969533  2.00039922 -1.00006208]
Iteration 10: [ 0.99996254  2.00002612 -0.99999928]
Iteration 11: [ 0.99999702  2.00000038 -0.99999933]
Iteration 12: [ 0.99999988  1.99999982 -0.9999999 ]
Iteration 13: [ 1.00000001  1.99999997 -0.99999999]
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