Soleymani, Fazlollah; **Lotfi, Taher**; **Bakhtiari, Parisa**

A multi-step class of iterative methods for nonlinear systems. (English) Zbl 1286.93068

Optim. Lett. 8, No. 3, 1001-1015 (2014).

Summary: In this article, the numerical solution of nonlinear systems using iterative methods are dealt with. Toward this goal, a general class of multi-point iteration methods with various orders is constructed. The error analysis is presented to prove the convergence order. Also, a thorough discussion on the computational complexity of the new iterative methods will be given. The analytical discussion of the paper will finally be upheld through solving some application-oriented problems.

MSC:

93B40 Computational methods in systems theory (MSC2010)
65H10 Numerical computation of solutions to systems of equations

Keywords:

nonlinear systems; matrix; LU factorization; computational complexity; nonlinear differential equations

Software:

Mathematica

Full Text: DOI

References:

[1] An, H.-B., Bai, Z.-Z.: A globally convergent Newton-GMRES method for large sparse systems of nonlinear equations. Appl. Numer. Math. 57, 235–252 (2007) · Zbl 1123.65040 · doi:10.1016/j.apnum.2006.02.007

[2] An, H.-B., Mo, Z.-Y., Liu, X.-P.: A choice of forcing terms in inexact Newton method. J. Comput. Appl. Math. 200, 47–60 (2007) · Zbl 1112.65044 · doi:10.1016/j.cam.2005.12.030

[3] An, H.-B., Wen, J., Feng, T.: On finite difference approximation of a matrix-vector product in the Jacobian-free Newton–Krylov method. J. Comput. Appl. Math. 236, 1399–1409 (2011) · Zbl 1258.65049 · doi:10.1016/j.cam.2011.09.003

[4] Bailey, D.H., Barrio, R., Borwein, J.M.: High-precision computation: Mathematical physics and dynamics. Appl. Math. Comput. 218, 10106–10121 (2012) · Zbl 1248.65147 · doi:10.1016/j.amc.2012.03.087

[5] Ben-Israel, A., Greville, T.N.E.: Generalized Inverses, 2nd edn. Springer, Berlin (2003) · Zbl 1026.15004

[6] Cordero, A., Hueso, J.L., Martinez, E., Torregrosa, J.R.: A modified Newton–Jarratt's composition. Numer. Algorithms 55, 87–99 (2010) · Zbl 1251.65074 · doi:10.1007/s11075-009-9359-z

[7] Cruz, W.L., Martinez, J.M., Raydan, M.: Spectral residual method without gradient information for solving large-scale nonlinear systems of equations. Math. Comput. 75, 1429–1448 (2006) · Zbl 1122.65049 · doi:10.1090/S0025-5718-06-01840-0

[8] Dayton, B.H., Li, T.-Y., Zeng, Z.: Multiple zeros of nonlinear systems. Math. Comput. 80, 2143–2168 (2011) · Zbl 1242.65102 · doi:10.1090/S0025-5718-2011-02462-2

[9] Hirsch, M.J., Pardalos, P.M., Resende, M.G.C.: Solving systems of nonlinear equations with continuous GRASP. Nonlinear Anal. Real World Appl. 10, 2000–2006 (2009) · Zbl 1163.90750 · doi:10.1016/j.nonrwa.2008.03.006

[10] http://www.wolfram.com/learningcenter/tutorialcollection/UnconstrainedOptimization/

[11] http://mathematica.stackexchange.com/questions/11364/how-do-i-find-all-the-solutions-of-three-simultaneous-equations-within-a-given-b

[12] Jarratt, P.: Some fourth order multipoint iterative methods for solving equations. Math. Comput. 20, 434–437 (1966) · Zbl 0229.65049 · doi:10.1090/S0025-5718-66-99924-8

[13] Montazeri, H., Soleymani, F., Shateyi, S., Motsa, S.S.: On a new method for computing the numerical solution of systems of nonlinear equations. J. Appl. Math., 2012, Article ID 751975, 15 p, (2012) · Zbl 1268.65075

[14] Ortega, J.M., Rheinboldt, W.C.: Iterative Solution of Nonlinear Equations in Several Variables. Academic Press, New York (1970) · Zbl 0241.65046

[15] Rheinboldt, W.C.: Methods for Solving Systems of Nonlinear Equations, 2nd edn. SIAM, Philadelphia (1998) · Zbl 0906.65051

[16] Sauer, T.: Numerical Analysis, 2nd edn. Pearson (2012) · Zbl 1229.91347

[17] Semenov, V.S.: The method of determining all real nonmultiple roots of systems of nonlinear equations. Comput. Math. Math.

Phys. 47, 1428–1434 (2007) · doi:10.1134/S0965542507090047

[18] Shen, C., Chen, X., Liang, Y.: A regularized Newton method for degenerate unconstrained optimization problems. Optim. Lett. 6, 1913–1933 (2012) · Zbl 1258.90106 · doi:10.1007/s11590-011-0386-z

[19] Themistoclakis, W., Vecchio, A.: On the solution of a class of nonlinear systems governed by an \$\$M\$\$ -matrix. Discret. Dyn. Nat. Soc., 2012, Article ID 412052, 12 p · Zbl 1248.65052

[20] Traub, J.F.: Iterative Methods for the Solution of Equations. Prentice Hall, New York (1964) · Zbl 0121.11204

[21] Tsoulos, I.G., Stavrakoudis, A.: On locating all roots of systems of nonlinear equations inside bounded domain using global optimization methods. Nonlinear Anal. Real World Appl. 11, 2465–2471 (2010) · Zbl 1193.65078 · doi:10.1016/j.nonrwa.2009.08.003

[22] Thukral, R.: Further development of Jarratt method for solving nonlinear equations. Adv. Numer. Anal., 2012, Article ID 493707, 9 p · Zbl 1250.65068

[23] Wagon, S.: Mathematica in Action. Springer, Berlin (2010) · Zbl 1198.65001