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**Olga Brezhneva\*** ([brezhnoa@muohio.edu](mailto:brezhnoa@muohio.edu)), Department of Mathematics and Statistics, Miami University, Oxford, OH 45056. *Numerical Methods for Solving Ill-conditioned Nonlinear Systems*. Preliminary report.

We propose a numerical method with superlinear convergence on the ill-conditioned and singular systems of nonlinear equations. The standard methods for solving the nonlinear equation  $F(x) = 0$  base each iteration on a linear approximation of  $F$ . However, when the Jacobian matrix  $F'(x^*)$  is singular or ill-conditioned at the solution  $x^*$ , the linear approximation does not adequately describe the mapping  $F$  in a neighborhood of  $x^*$ . Hence, the standard methods are inefficient on the ill-conditioned problems. We base our approach on using a higher order information about  $F$ . The presented results can be applied to many classes of problems including systems produced by discretizations of boundary-value problems for partial and ordinary differential equations. We compare the proposed method with other existing approaches including tensor methods. (Received September 28, 2005)