SOLVING NONLINEAR SYSTEM OF EQUATION BASED ON MATLAB GUI

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ABSTRACT

Nonlinear systems are prevalent in numerous scientific and engineering fields, presenting unique challenges due to their complex behavior and the potential for multiple solutions. The numerical methods implemented in this project include Newton's Method, Broyden's Method, the Broyden-Fletcher-Goldfarb-Shanno (BFGS) Method, the Steepest Descent (SD), and Fsolve method. The main objectives of this project were to review the results of applying the Newton, Broyden, BFGS, SD, and Fsolve methods to the numerical solution of a system of nonlinear equations and to create a user-friendly MATLAB GUI that simplifies the process for users. The solver accepts user inputs for functions, jacobians, and initial values, and outputs the number of iterations, norm of gradients to reach a solution. Extensive testing was conducted using ten standard test functions to evaluate the performance of each method. The results demonstrate that while Newton's Method generally converges faster, Broyden's and BFGS Methods offer computational advantages in scenarios where the Jacobian matrix is challenging to compute. The SD Method, although slower, provides reliable convergence for specific types of problems. This project not only highlights the strengths and weaknesses of each numerical method but also contributes a practical tool for researchers and engineers to solve complex nonlinear systems efficiently. The developed MATLAB GUI stands out for its ease of use, visual appeal, and adaptability to various applications, making it a valuable addition to the computational tools available in mathematical modelling and analytics.

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