Solution of Non-linear Equations Using Newton Raphson and Quasi-Newton Method and Application in Engineering Field

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ABSTRACT

In this review paper, a study is done on the linearisation of the existing algorithm of the Newton-Raphson method for solving systems of non-linear equations of higher dimensions and improving the converging behaviour of the Newton-Raphson method, which differs in the case of finite elemental systems. Newton's approach is the first method to be reviewed in this paper, elucidating non-linear systems of equations with each possibility of solution of equations. This paper introduces the notion of Jacobian, discussing the inverse function theorem and define locally unique solutions along with the order of convergence of Newton Raphson. Furthermore, this paper includes the two best criteria for knowing when to end iterations, with some numerical examples to explain the algorithm and utilitarian of this method for solving non-linear systems, mentioning the shortcoming of the method and introducing Broyden's approach (also known as Broyden's method for finding an iterative formula for Jacobian inverse), which is evolved from Newton's method, and using the fixed difference approach to find ways for Jacobian computing, and lastly, including the gravity of this method in the engineering field.

Keywords: Numerical Solutions, Newton-Raphson, Non-linear, Linearisation, Jacobian, Quasi-Newton, Approximations.

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