World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:13, No:04, 2019

A Modified Nonlinear Conjugate Gradient Algorithm for Large Scale Unconstrained Optimization Problems

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Abstract : It is well known that nonlinear conjugate gradient method is one of the widely used first order methods to solve large scale unconstrained smooth optimization problems. Because of the low memory requirement, attractive theoretical features, practical computational efficiency and nice convergence properties, nonlinear conjugate gradient methods have a special role for solving large scale unconstrained optimization problems. Large scale optimization problems are with important applications in practical and scientific world. However, nonlinear conjugate gradient methods have restricted information about the curvature of the objective function and they are likely less efficient and robust compared to some second order algorithms. To overcome these drawbacks, the new modified nonlinear conjugate gradient method is presented. The noticeable features of our work are that the new search direction possesses the sufficient descent property independent of any line search and it belongs to a trust region. Under mild assumptions and standard Wolfe line search technique, the global convergence property of the proposed algorithm is established. Furthermore, to test the practical computational performance of our new algorithm, numerical experiments are provided and implemented on the set of some large dimensional unconstrained problems. The numerical results show that the proposed algorithm is an efficient and robust compared with other similar algorithms.

Keywords : conjugate gradient method, global convergence, large scale optimization, sufficient descent property
Conference Title : ICAMEM 2019 : International Conference on Applied Mathematics and Engineering Mathematics
Conference Location : New York, United States
Conference Dates : April 22-23, 2019