Compound step-size methods in unconstrained nonlinear optimization

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Various improvements of gradient-descent and conjugate-gradient methods for solving nonlinear the unconstrained optimization problem are investigated. More specifically, we investigate possibility of using composite step size in gradient-descent and conjugate-gradient algorithms. The composite step size is generated as a function of different parameters. The first modification suggests a slight increase in the step size involved in gradient-descent methods. Another class of methods utilizes additional parameters which are defined using appropriate scalar approximations of the Hessian. One possibility to define additional tuning in optimization methods occurs by hybridizing gradient descent methods with the Picard-Mann-Ishikawa iterative process. An additional approach to defining acceleration parameters is based on the application of the neutrosophic logic and three membership functions in determining appropriate step size for a class of descent direction methods. It is proved that the proposed methods are linearly convergent for uniformly convex functions as well as under some standard conditions. Numerical tests and comparisons are presented.

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