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Modified Parameter of the Dai–Liao Conjugacy Condition of the Conjugate Gradient Method with Some Applications

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Abstract: This study introduces a novel modification of the conjugate gradient (CG) method by refining the Dai–Liao conjugacy parameter and incorporating a restart property. The proposed method, which is established in the Hestenes–Stiefel framework, is designed to ensure global convergence and satisfies the sufficient descent condition for both convex and non-convex functions. Utilizing the Lipschitz constant as a foundation, the method's efficiency and robustness were benchmarked against CG Descent across over 200 functions from the CUTEst library. Numerical experiments revealed superior performance in terms of CPU time, iterations, gradient evaluations, and function evaluations. Additionally, practical applications in heat conduction and image restoration demonstrate the method's versatility and effectiveness.

Keywords: conjugate gradient; inexact line search; conjugacy condition; global convergence; CUTEst library.

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