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CG-OPT: A Comparative Empirical Analysis of Conjugate Gradient Methods via Performance Profiles

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Abstract

This study presents a comprehensive empirical comparative analysis of three conjugate gradient methods for large-scale nonlinear optimization: CG-OPT (a novel hybrid method), PRP+ (modified Polak–Ribière–Polyak), and CG-DESCENT (the Hager–Zhang algorithm). Using the Dolan–Moré performance profile methodology, we evaluate these algorithms on a set of 150 test problems from the CUTEst library, with dimensions ranging from 50 to 10,000 variables. Our results demonstrate that CG-OPT significantly outperforms both reference methods in terms of effciency and robustness.

Keywords: Nonlinear optimization, conjugate gradient, hybrid methods.

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