A NEW TYPE OF CONJUGATE GRADIENT METHODS WITH SUFFICIENT DESCENT PROPERTY FOR UNCONSTRAINED OPTIMIZATION

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Conjugate gradient methods (CG) have an important part in unconstrained optimizations. Numerous studies and modifications have been concerned to improve these methods. In this study, two modifications of the CG coefficient (β_k) are proposed in a way to solve unconstrained optimization problems using exact line searches and inexact line searches by employing strong Wolfe line search.

Theoretical proof has shown that these β_k fulfilled enough descent conditions and has global convergence properties. They also possessed linear convergence rates and are in line with the angle condition, suggesting that these coefficients always converge faster than steepest descent methods.

All these new β_k are tested based on twenty two standard optimization test problems using MATLAB version 7.10.0 (R 2010a) subroutine programing and compared with

classical formula of conjugate gradient methods, namely Fletcher and Reeves (FR), Polak, Ribiere and Polyak (PRP) and new version of Rivaie, Mustafa, Ismail and Leong (RMIL) method. The test functions choosen consist of small and large-scale problems. For every problem, four initial points are used, ranging from that is nearest to the solution point, to that furthest away.

The numerical results based on the number of iterations and CPU times are analyzed using the performance profile done by Dolan and More. It is clear that these new formulas perform better than the FR, PRP and RMIL methods, retain their simplicity, and possess sufficient descent condition and global convergence properties. It is also shown that the numerical results are in line with the theoretical proof.

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SEJENIS KAEDAH KECERUNAN KONJUGAT BARU DENGAN SIFAT CUKUP MENURUN BAGI PENGOPTIMUMAN TAK BERKEKANGAN

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Kaedah kecerunan konjugat (KK) memainkan peranan yang penting dalam pengoptimuman tak berkekangan. Banyak kajian dan pengubahsuaian telah dilakukan bagi menambahbaik kaedah ini. Dalam kajian ini, dicadangkan dua pengubahsuaian bagi pekali KK untuk menyelesaikan masalah pengoptimuman tak berkekangan dengan menggunakan garis carian tepat dan garis carian tak tepat kuat Wolfe.

Pembuktian secara teori menunjukkan bahawa β_k memenuhi syarat menurun dan mempunyai sifat penumpuan sejagat. Juga didapati kadar penumpuannya secara linear dan sesuai dengan syarat sudut, dan pekali ini sentiasa menumpu lebih cepat dari kaedah penurunan tercuram.

Semua β_k yang dicadangkan diuji ke atas dua puluh dua masalah pengoptimuman piawai dengan menggunakan subrutin pengaturcara MATLAB versi 7.10.0 (R 2010a) dan dibandingkan dengan kaedah oleh Flecther dan Reeves (FR), Polak, Ribiere dan Polyak (PRP) dan versi baru Rivaie, Mustafa, Ismail dan Leong (RMIL). Fungsi ujian dipilih mengandungi skala kecil dan besar. Untuk setiap masalah, empat titik awal digunakan; dengan julat dekat dan jauh dari penyelesaian.

Keputusan berangka berdasarkan bilangan lelaran dan masa CPU dianalisa dengan menggunakan profil prestasi yang disarankan oleh Dolan dan More. Adalah jelas menunjukkan bahawa rumus yang dicadangkan jauk lebih baik berbanding dengan kaedah FR, PRP dan RMIL, mengekalkan simplisiti dan mengandungi syarat cukup menurun dan bersifat penumpuan sejagat. Keputusan berangka menunjukkan ianya sejajar dengan pembuktian secara teori.