A variant of IDRstab to remedy the residual gap

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The IDRstab method [3] has been proposed for solving large nonsymmetric linear systems. IDRstab is often more effective than both the IDR(s) method [4] and the BiCGstab(ℓ) method [2]. However IDRstab sometimes has a so-called *residual gap*; the convergence of recursively computed residual norms does not coincide with that of true residual norms by numerical errors. In this talk, we propose to use an alternative recursion formula for updating the residuals in order to remedy the residual gap. Here the alternative formulation is more reliable than the original one, but some extra matrix-vector multiplications are required. Nevertheless, the computational costs for vector updates of IDRstab are comparable to that for the matrix-vector multiplications. The actual computation time significantly depends on the computational costs for vector updates in the case of large sparse linear systems [1]. We therefore derive an alternative implementation of IDRstab with an idea of saving the costs for vector updates to remedy the residual gap. Numerical experiments demonstrate that our variant of IDRstab converges without the residual gap on some model problems. A reliability of the recursion formulas for updating the residuals is also discussed through the numerical experiments to reveal a merit of the alternative recursion formula used in our variant of IDRstab.

References

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