# Flexible and Multi-Shift Induced Dimension Reduction Algorithms for Solving Large Sparse Linear Systems

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IDR($s$) is one of the most efficient methods for solving large sparse nonsymmetric linear systems of equations. We present two useful extensions of IDR($s$), namely a flexible variant and a multi-shift variant. The algorithms exploit the underlying Hessenberg decomposition computed by IDR($s$) to generate basis vectors for the Krylov subspace. The approximate solution vectors are computed using a Quasi-Minimization approach. Numerical examples are presented to show the effectiveness of these new IDR variants compared to existing ones and to other Krylov subspace methods.

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