

Efficient A-stable peer two-step methods

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Efficient peer methods for stiff initial value problems should satisfy different criteria like a large angle of $A(\alpha)$ -stability, uniform zero-stability for time-adaptive grids and small error constants or superconvergence. We present a new algebraic criterion for A-stability, which requires semi-definiteness of a certain matrix. In fact, A-stable and superconvergent peer methods with s stages can be characterized by a set of $O(s^2)$ nonlinear equations. Also, a new criterion for uniform zero stability is formulated leading to a finite set of inequalities. Hence, peer-methods satisfying all 3 criteria can be constructed by solving a set of nonlinear inequalities with standard methods. Peer methods found with this procedure are compared with existing ones on a few test problems.