Peer methods for the numerical solution of general second order IVPs

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In this work, we solve numerically general second order initial vale problems $y'' = f(t, y, y')$ by means of explicit two-step Peer methods, given by

$$\begin{aligned} Y_{m+1} &= BY_m + hAZ_m + h^2QF_{m-1} + h^2RF_m, \\ Z_{m+1} &= \widehat{B}Z_m + h\widehat{Q}F_{m-1} + h\widehat{R}F_m, \end{aligned} \tag{1}$$

where the stage vectors evaluated at $t_{mi} = t_m + c_i h$ are

$$\begin{aligned} Y_m &= (Y_{mi}), \text{ where } Y_{mi} \simeq y(t_{mi}), \\ Z_m &= (Z_{mi}), \text{ where } Z_{mi} \simeq y'(t_{mi}), \\ F_m &= (f(t_{mi}, Y_{mi}, Z_{mi})). \end{aligned} \tag{2}$$

We propose explicit Peer methods with minimum number of effective function evaluations per step. We analyze the 0-stability, consistency and convergence of these schemes.

References

1. S. Jebens, R. Weiner, H. Podhaisky, B.A. Schmitt. Explicit multi-step peer methods for special second-order differential equations. *Applied Mathematics and Computation* **202** 803–813, 2008

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