Explicit peer methods with variable nodes

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We consider a special class of explicit general linear methods, explicit peer methods with s stages as introduced in [2] of the form

$$U_{m,i} = \sum_{j=1}^{s} b_{ij} U_{m-1,j} + h_m \sum_{j=1}^{s} a_{ij} f(t_{m-1,j}, U_{m-1,j}) + h_m \sum_{j=1}^{i-1} r_{ij} f(t_{m,j}, U_{m,j}),$$
$$i = 1, \ldots, s$$

for the solution of nonstiff initial value problems. In general, these methods require s function calls per step. By using a special structure of the coefficients of the explicit peer method [1], we say an explicit peer method has n_s shifted stages and $s_e = s - n_s$ effective stages, it is possible to reduce the number of function evaluations per step to s_e. This implies for variable step sizes variable nodes, which depend on the step size ratio and the nodes of the previous step. In this talk we present methods with $s = 4, 5, 6$ stages and $n_s = 2, 3$ shifted stages of order $p = s$ (for constant step sizes superconvergent of order $p = s + 1$) which are tested in MATLAB and compared with `ode23` and `ode45`.

References

1. HORVÁTH, Z., H. PODHAISKY and R. WEINER: *Strong stability preserving explicit peer methods*. Reports of the Institute of Mathematics, University of Halle, No. 4, 2014.

2. WEINER, R., K. BIERMANN, B.A. SCHMITT and H. PODHAISKY: *Explicit two-step peer methods*. Computers & Mathematics with Applications, 55(4):609-619, 2008.