Global error control with peer methods

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In common ode methods the step size control is based on the estimation of the local error, and decreasing the tolerances will lead to a reduction of the global error. However, the proportionality factor between local and global error is unknown, often the global error exceeds the local tolerance by several magnitudes. In these cases a global error control is desirable.
We consider global error control with peer triples, both explicit for nonstiff and implicit for stiff problems. In the nonstiff case we combine two methods of orders 5 and 6. In the stiff case the methods have to be chosen carefully to use the same coefficient matrices in the Newton iteration and to have good stability properties. We present methods of orders 2 and 3 which are superconvergent of orders 3 and 4 for constant step sizes. Numerical tests show the reliability of our approach, the prescribed global accuracy is met in all problems. Furthermore, comparison with the built-in MATLAB codes shows the efficiency of our methods.