Stiff order conditions for high-order exponential integrators

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In recent years, exponential integrators have shown to be very competitive for the numerical solution of large systems of stiff differential equations. The construction of high-order methods relies on the knowledge of the (stiff) order conditions, which are available in the literature up to order four. In this talk, we present a new and simple approach to derive these conditions for exponential Runge–Kutta and exponential Rosenbrock-type methods. Exemplarily, we work out our approach for order five which enables us to construct fifth-order methods. Our setting is adapted to stiff problems and allows us to prove convergence results for variable step size implementations, independently of the stiffness of the problem. Numerical results show that the new integrators are highly competitive.