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Adapted peer methods for oscillatory problems

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We consider systems of ordinary differential equations with oscillating solutions, which, for example, arise in the spatial semi-discretization of partial differential equations in the modelization of advection-diffusion problems in hydrodynamic [1]. In this case, the use of a non-polynomial bases shows a significant instrument to adapt numerical methods to the known qualitative behavior of the exact solution. The exponential fitting technique goes in this direction, permitting to develop efficient and accurate numerical methods.

We present a general class of exponentially fitted two-step peer methods for numerical integration of ordinary differential equations with oscillatory solution [2, 3]. The attribute *peer* means that all s stages have the same characteristics of accuracy and stability, so they are very useful for stiff problems because they do not suffer from the order reduction phenomenon. Moreover peer methods are very appropriate for parallel implementation, which may be necessary when the number of spatial points increases. The effectiveness of this problem-oriented method is confirmed by numerical experiments.

References

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