On the numerical treatment of selected oscillatory evolutionary problems

Angelamaria Cardone, Dajana Conte, Raffaele D'Ambrosio, Beatrice Paternoster

Department of Mathematics, University of Salerno, 84084 Fisciano, Italy

The talk is focused on the numerical solution of differential problems, whose qualitative behaviour is known a-priori. In particular, the investigation is oriented to problems with oscillatory solutions, with special reference to reaction-diffusion problems and stochastic differential equations.

As it regards, reaction-diffusion systems, the investigation is devoted to nonlinear problems generating periodic wavefronts, with special interest to $\lambda-\omega$ problems. In this case, an adapted numerical approach results to be more efficient, accurate and stable in comparison to a general purpose numerical scheme ignoring the qualitative behaviour of the problem. An adapted method of lines will be presented, relying on trigonometrically fitted finite differences. The numerical scheme will also be analyzed in terms of accuracy and stability properties, also in comparison with its classical counterpart.

Concerning stochastic differential equations, the presentation will mainly be devoted to the numerical treatment of damped stochastic oscillators. For such problems, mainly given by second order problems in time, the long terms dynamics is known to be distributed according to a normal distribution, for which is it possible to easily compute long term statistics. The talk analyzes the properties of stochastic linear multistep methods in retaining this invariance law for long time.

References

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