APPROXIMATED LAX PAIR FOR NONLINEAR EVOLUTION EQUATIONS

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Abstract

The purpose of this talk will be to present a new reduced-order modelling approach to solve nonlinear evolution partial differential equations. It is based on approximations of generalized Lax pairs. Contrary to other reduced-order methods, the basis on which the solution is searched for evolves in time according to a dynamics specific to the problem. It is therefore well-suited to solving problems with progressive front or wave propagation. Another difference with other reduced-order methods is that it is not based on an off-line / on-line strategy. The method will be illustrated on various problems, including Korteweg-de Vries, Fisher-Kolmogorov and the so-called "bidomain" equations, used in cardiac electrophysiology.

A new variant of our approach, based on the Discrete Empirical Interpolation Methods, will be also presented. It allows for a significant speed-up and the possibility to efficiently handle nonpolynomial nonlinearities.

Reference

[1] J.-F. Gerbeau, D. Lombardi: *Approximated Lax pairs for the reduced order integration of nonlinear evolution equations.* J. Comput. Phys. 265 (2014), 246–269.

[2] J.-F. Gerbeau, D. Lombardi, E. Schenone: *Reduced order model in cardiac electrophysiology with approximated lax pairs.* To appear in Adv. Comput. Math., 2014. http://dx.doi.org/10.1007/s10444-014-9393-9