Fourteenth International Conference Zaragoza-Pau on Mathematics and its Applications
Jaca, September 12–15th 2016

Techniques for constructing efficient exponential methods of EPIRK type and applications

Mayya Tokman

SUMMARY

Exponential integrators offer computational advantages to solving large stiff systems of differential equations compared to standard methods. There are a number of ways exponential propagation can be used in building an efficient time integrator. One can construct an exponential scheme that advances the complete system in time in a self-consistent manner. On the other hand, for certain types of problems it is more advantageous to build a composite time integrator that includes elements of exponential, implicit and explicit integration. Exponential propagation iterative methods of Runge–Kutta type (EPIRK) offer flexibility that allows construction of various integrators that have computational advantages for different types of problems. We will discuss the main points that have to be addressed in constructing an efficient time integrator in the EPIRK framework. Different types of methods such as implicit-exponential (IMEXP), partitioned, and hybrid EPIRK schemes will be described. Using numerical experiments we will demonstrate when and what kind of computational savings can be expected from these techniques.

Keywords: exponential integration, time integrators, numerical methods,...

AMS Classification: 65L04, 65L05, 65L20

[1]School of Natural Sciences
University of California, Merced
email: mtokman@ucmerced.edu