

***Stable and positivity preserving solvers for time-fractional
reaction-advection-diffusion problems***

Angelamaria Cardone (University of Salerno), Gianluca Frasca Caccia,
Beatrice Paternoster

Reaction-advection-diffusion problems, where the memory effect plays an important role, may be successfully modeled by partial differential equations with a fractional derivative in time. In the numerical simulation, main concerns regard the accuracy, since most standard schemes exhibit low order of convergence; the computational cost, due to the discretization of the history term. Moreover, in real applications, another issue is the preservation of qualitative properties of the analytical solution, which is usually achieved only for small stepsizes. Here, we propose two pairs of nonstandard time-stepping methods, which are unconditionally stable and positivity preserving. The analysis of these methods is illustrated and some numerical experiments are shown for comparison with classical methods.

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