Technische Universität Braunschweig

MUSEN

Structure-preserving numerical schemes for nonlinear evolution equations

Lecture of

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Solutions to evolution equations often preserve a number of quantities like positivity, mass conservation, and energy dissipation. Numerical schemes should be designed in such a way that these structures, including the correct large-time asymptotics, are preserved. In this talk, we present a number of recent results on structure-preserving schemes, including Runge-Kutta and one-leg multi-step time approximations and finite-volume space discretizations, by combining techniques from stochastic analysis, theory of partial differential equations, and numerical analysis. The results are based on novel techniques like systematic integration by parts, discrete Bakry-Emery methods, and the boundedness-by-entropy method. Numerical simulations for porous-medium equations and cross-diffusion systems for ion transport illustrate the theoretical results.