Nonnegativity Preserving Numerical Algorithms for Stochastic Differential Equations

Preprint m-05-006

Esteban Moro and Henri Schurz

Grupo Interdisciplinar de Sistemas Complejos (GISC) and Departamento de Matemáticas, Universidad Carlos III de Madrid, Avenida de la Universidad 30, 28911 Leganés, Spain

Department of Mathematics, Southern Illinois University Carbondale Carbondale, IL 62901-4408, USA and Texas Tech University, Department of Mathematics and Statistics, Lubbock, TX 79409-1042, USA

ABSTRACT: Construction of splitting-step methods and properties of related non-negativity and boundary preserving numerical algorithms for solving stochastic differential equations (SDEs) of Itô-type are discussed. We present convergence proofs for a newly designed splitting-step algorithm and simulation studies for numerous numerical examples ranging from stochastic dynamics occurring in asset pricing theory in mathematical finance (SDEs of CIR and CEV models) to measure-valued diffusion and superBrownian motion (SPDEs) as met in biology and physics.

Key words. stochastic differential equations, absorbing boundary, numerical methods, super-Brownian motion, splitting-step algorithm, convergence, non-negativity, simulation