A Lie algebraic approach to numerical integration of stochastic differential equations

Tetsuya Misawa
misawa@econ.nagoya-cu.ac.jp
Nagoya City University, Japan

In this talk, "composition methods (or operator splitting methods) "for autonomous stochastic differential equations (SDEs) are formulated to make numerical approximation schemes for the equations. In the methods, the exponential map, which is given by solution of a stochastic differential equation, is approximated by composition of the stochastic flows derived from simpler and exact integrable vector field operators having stochastic coefficients. The error-orders of the numerical schemes derived from the stochastic composition methods are investigated. The new schemes are advantageous to preserve the special character of SDEs numerically and are useful for approximations of the solutions to stochastic non-linear equations. To examine the superiority, several numerical simulations on the basis of the schemes are carried out for stochastic differential equations which are treated in the mathematical finance and stochastic Hamilton dynamical systems.

Key words. stochastic differential equations, Lie algebra, BCH formula, composition methods (operator splitting method).