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ENERGY/LYAPUNOV FUNCTION METHOD AND STOCHASTIC MATHEMATICAL FINANCE

G. S. Ladde

Department of Mathematics and Statistics

University of South Florida

Tampa, FL 33620 USA

gladde@usf.edu

ABSTRACT

In this work, we present a very general conceptual algorithm for finding a solution process of a class of first order nonlinear stochastic differential equations of Itô-Doob type. It is assumed that the given stochastic differential equation has solution. The basic ideas are:1) seeking an unknown energy function, 2) associating a simpler differential equation, 3) determining energy function in the context of a simpler Itô-Doob type stochastic differential equation and the original nonlinear differential equation, and 4) finding a solution representation of the original stochastic differential equation in the context of energy function and the solution process of simpler stochastic differential equation. We note that during the reduction process a simpler stochastic differential equation, the energy function and rate functions of simpler stochastic differential equations are determined. A solution of the original nonlinear stochastic differential equation is recast in the context of the energy function and the solution of easily solvable stochastic differential equations such as: (a) the directly integrable differential equation, and (b) a first order linear differential equation, and etc.