Digital simulation of stochastic differential equations

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1985.

Abstract:

The study of stochastic differential equations started with mathematicians using them as tools in the solution of physical problems. In science and engineering, s.d.e. arise in a natural phenomenon known as "white noise". Some of the major works done in this area of study has been in the analytical solution of s.d.e. Very little attention has been paid to digital simulation techniques.

In this thesis we have evolved a digital and analog simulation technique for solving s.d.e s. We have used the TRS-80 model II microcomputer system at the University of Ife, Nigeria and the 680 analog/parallel logic computer system of the University of Sussex; U.K. in our digital simulation procedures.

We have used the improved Euler's and Runge-Kutta's methods of numerical integration. We have solved some problems in science and engineering using the digital simulation techniques evolved. These problems are s.d.e. describing: the white noise, the Lagevin's equation, the influence of a rapidly fluctuating density of the earth on the motion of a satelite in a circular orbit, the motion of a rigid body rotating under a random force, the Fokker-Planks equation. We have also considered the convergence of the results and the probable error in the simulation experiments.

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39p

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