On the numerical solution of stochastic oscillators driven by time-varying and random forces

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ABSTRACT

In this talk, we focus on stochastic armonic undamped oscillators driven by both a deterministic time-dependent force and a random Gaussian forcing. This is modeled by a second order stochastic differential equation of the type:
\[ \ddot{x} = -\omega^2 x + g(t) + \varepsilon \xi(t) \]  
(1)

where \( \xi(t) \) is a white noise process satisfying \( E[\xi(t)\xi(t')] = \delta(t - t') \) and \( \omega \) is a positive real constant. Providing accurate numerical methods for discretizing mathematical models of oscillating phenomena is a very thorough topic. Scientific literature is extremely rich in models describing the dynamics of different types of oscillators, both in deterministic and stochastic setting. Because of the variety of models, an appropriate numerical treatment for any particular kind of oscillator is required. More specifically, many interesting examples of stochastic oscillator are obtained by the introduction in the equation of a deterministic oscillator of a noisy ingredient, which can be, for example, an additive and/ or a multiplicative noise, a random frequency, a random damping, and so on (see [1] and references therein for a survey). Our aim is to join two ingredients, i.e. a variation of constant formula and specific quadrature rules to define a numerical treatment specific for problem (1). Numerical experiments confirm the effectiveness of the approach.

REFERENCES


