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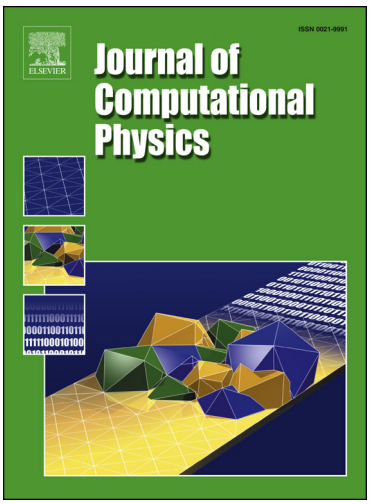

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Waad Subber, Abhijit Sarkar

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A Parallel Time Integrator for Noisy Nonlinear Oscillatory Systems

Waad Subber[a], Abhijit Sarkar[b,*]

[a]*Department of Civil and Environmental Engineering, Carleton University, Ottawa, Ontario K1S5B6, Canada.*
Currently at the University of Notre Dame, Indiana, United States.
[b]*Department of Civil and Environmental Engineering, Carleton University, Ottawa, Ontario K1S5B6, Canada.*

Abstract

In this paper, we adapt a parallel time integration scheme to track the trajectories of noisy non-linear dynamical systems. Specifically, we formulate a parallel algorithm to generate the sample path of nonlinear oscillator defined by stochastic differential equations (SDEs) using the so-called *parareal* method for ordinary differential equations (ODEs). The presence of Wiener process in SDEs causes difficulties in the direct application of any numerical integration techniques of ODEs including the parareal algorithm. The parallel implementation of the algorithm involves two SDEs solvers, namely a fine-level scheme to integrate the system in parallel and a coarse-level scheme to generate and correct the required initial conditions to start the fine-level integrators. For the numerical illustration, a randomly excited Duffing oscillator is investigated in order to study the performance of the stochastic parallel algorithm with respect to a range of system parameters. The dis-

*Corresponding author
Email addresses: wsubber@nd.edu (Waad Subber), abhijit_sarkar@carleton.ca (Abhijit Sarkar)