Technische Berichte

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Titel des Berichts:
Path-Wise Algorithms for Random & Stochastic ODEs with Applications to Ground-Motion-Induced Excitations of Multi-Storey Buildings

Abstract:
Random effects play a vital role in various physical phenomena and have to be addressed in the mathematical modeling and numerical simulations of such processes. In this contribution, the concepts of random (ordinary) differential equations (RODEs) and stochastic (ordinary) differential equations (SODEs) are reviewed. Details concerning the numerical solution of problems formulated via SODEs and RODEs are summarised. In particular, key features of the averaged Euler and Heun as well as K-RODE Taylor methods for RODEs are compared with numerical methods for SODEs such as the Euler-Maruyama and the Milstein scheme. Finally, the studied RODE and SODE methods are applied to one- and multi-dimensional examples, including the problem of ground-motion-induced excitations of multi-storey buildings subject to the Kanai-Tajimi earthquake model. Being paradigms for additive white noise driven systems, these applications illustrate on the one hand the applicability of the aforementioned numerical methods on an extremely wide class of problems. On the other hand, the coupled oscillator structure of the earthquake induced motion of multi-storey buildings naturally gives rise to the development of hybrid numerical schemes that combine averaged and deterministic schemes to fully exploit their benefits.

Stichworte:
random differential equation, stochastic differential equation, path-wise solution, numerical methods, Kanai-Tajimi earthquake model

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