MAX-PLANCK-INSTITUT
FÜR DYNAMIK KOMPLEXER
TECHNISCHER SYSTEME
MAGDEBURG

CSC Seminar

SPEAKER

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TITLE

Neural networks enhanced integrators for systems defined by ordinary differential equations

ABSTRACT

Many applications require numerical solutions to differential equations for a large number of initial conditions and/or system parameters. For example, the analysis of fatigue effects and lifetime prediction of technological systems such as wind energy converters (WECs) often requires a comparison of design site conditions with real site conditions by simulating models of WECs for a large number of different conditions. This contribution evaluates the effectiveness of neural network (NN) enhanced integrators. NNs learn the integration errors, the approximation of which are then used as an correction term for the numerical schemes. Such a hybrid approach aims to combine the physics-based classical numerical techniques with adaptive learning capabilities of neural networks, potentially mitigating the trade-off between computational load and error size. The resulting integrators are compared with well-established methods in numerical studies, with a particular focus on computational requirements. The analytical properties will be addressed in terms of local errors. Classical Runge-Kutta methods and symplectic integrators are considered.

Wednesday, December 11, 2024 at 10:00 am
seminar room Prigogine