

Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910



Prof. Dr. Jens Starke

Universität Rostock

“Equation-free analysis of collective behavior in particle models”

The coarse behavior and its parameter dependence in complex systems is investigated. For this, a numerical multiscale approach called equation-free analysis is further improved in the framework of slow-fast dynamical systems. The method allows to perform numerical investigations of the macroscopic behavior of microscopically defined complex systems including continuation and bifurcation analysis on the coarse or macroscopic level where no explicit equations are available. This approach fills a gap in the analysis of many complex real-world applications including particle models with intermediate number of particles where the microscopic system is too large for direct investigations of the full system and too small to justify large-particle limits. An implicit equation-free method is presented which reduces numerical errors of the analysis considerably. It can be shown in the framework of slow-fast dynamical systems, that the implicitly defined coarse-level time stepper converges to the true dynamics on the slow manifold. The method is demonstrated with applications to particle models of traffic as well as pedestrian flow situations. The results include an equation-free continuation of traveling wave solutions, identification of saddle-node and Hopf-bifurcations as well as two-parameter continuations of bifurcation points.

E. Schöll

Thursday, 10.11.16 · 16:15h · EW 202

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