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MATHEMATIKKOLLOQUIUM

Das Institut für Mathematik lädt zu folgendem Vortrag ein:

P. A. Zegeling

Department of Mathematics, Utrecht University

Detecting patterns in PDE models via adaptive grids

Complicated pattern formation can be found in many PDE models. Sometimes one can analyse the patterns, for example, the existence and stability of travelling waves, emerging spots and evolving spiral structures with dynamical systems theory, asymptotic methods, singular perturbations and other tools from applied analysis. Most of the time, however, one is restricted to numerical techniques to approximate, predict and explore the arising complex structures. In some cases, applied and numerical mathematics go even hand in hand, thereby stimulating each other in giving new insights in the model.

In this talk I will describe a sophisticated adaptive grid method with an "adaptive" monitor function that can automatically detect and follow steep and moving solutions of the PDEs. The adaptivity of the numerical grid is further controlled by keeping the non-uniform grid smooth enough to prevent both oscillations in the time-direction and to avoid big gaps in the spatial grid distribution. To show the effectiveness of the approach, several PDE models from different application areas are presented. We will discuss fingering patterns in two-phase (oil-water) models from hydrology, splitting-pulse behaviour in reaction-diffusion systems, a wave equation with a moving boundary (giving the
Casimir-effect) and so-called Liesegang patterns in a fourth-order Cahn-Hilliard PDE coupled to a system of chemical reaction-diffusion equations. Additionally, in the Cahn-Hilliard model and the hydrology model we have used a splitting technique to lower the order of the equation, while the number of equations is increased.
As a consequence, a small artificial time-derivative term must be added, thereby opening the possibility of an analysis in terms of singular perturbation theory and using slow and fast variables.

Zeit: **Dienstag, den 19. Januar 2010 um 17:15 Uhr**

Ort: **Victor-Franz-Hess Haus, Technikerstraße 25, HS F**

Gäste sind herzlich willkommen!

Felix Kramer