Karlsruhe Institute of Technology

Seminar of the Work Group
Nonlinear Partial Differential Equations
SS 23

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A Non-local Free Boundary Problem Arising in a Model of Cell Polarization

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Abstract

We consider a model for cell polarization as a response to an external signal which consists of a bulk-surface reaction-diffusion system of equations. We have proved that in a suitable scaling limit the system converges to a non-local free boundary problem. In this talk, I will present several results for this problem, starting with an L1-contraction property and, in the case of time-constant signals, the stability of stationary states. To gain more insight into the evolution of the support of the solution, we further investigate qualitative properties of the free boundary. In particular, we have concluded that there are necessary and sufficient conditions for the initial data that yield continuity of the support at $t = 0$. If one of these assumptions fail, then jumps of the support take place. In addition we have provided a complete characterization of the jumps for a large class of initial data.

This is a joint work with B. Niethammer, M. Röger and J. J. L. Velázquez.