FAKULTÄT FÜR MATHEMATIK
Dekan Univ.-Prof. Dr. Radu Ioan Bot

Einladung zur öffentlichen Defensio von

Giulia Pilli

Thema der Dissertation
On PDE models for transportation networks

Abstract:

This thesis contains a study of PDE-models describing the formation of network struc-tures in biological systems. In particular, we consider a fluid moving through a porous medium. In this setting the presence of the medium influences the flux of the fluid, both in direction and intensity. This phenomenon is described by Darcy's law, that connects the flux with the conductivity, a physical quantity representing in each point how easily the fluid can move and which is the best direction. This interaction is math-ematically described via the action of the so-called permeability tensor on the gradient of the pressure of the fluid.

After presenting some of the already existing models, I will introduce Murray's law, which describes for biological systems the relation between the thickness of branches connected in a node. I will then show a generalisation of this law both for a discrete model, first introduced by Hu and Cai, and for the steady states of a continuum model derived from phenomenological considerations.

I will then proceed by introducing a continuum model which studies the evolution of the permeability tensor. Its evolution in time is defined as the L2-gradient flow of an energy functional which takes into consideration a diffusive term, a kinetic one and a metabolic cost

The last part of the talk is dedicated to the first results of a work in progress, which considers an energy for a scalar conductivity that contains a diffusive term, a kinetic part and a metabolic one. In particular, we aim to prove the existence of a Γ-limit for this energy as the diffusion coefficient goes to zero.

Prüfungssenat
Univ.-Prof. Mag. Dr. Andreas Cap
(Vorsitz)

 o. Univ.-Prof. Dr. Peter Markowich
(Universität Wien)

Prof. Dr. Athanasios Tzavaras
(King Abdullah University of Science and Technology)

Prof. Dr. Giovanni Russo
(University of Catania)

Zeit:

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Topic: Thesis defense Giulia Pilli
Time: Dec 1, 2022 09:30 Vienna

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