非線形解析セミナー (拡大版)

日時: 2023 年 11 月 24 日 (金) 10:00〜17:30
場所: 矢上キャンパス 14 棟 7 階 733 室
アクセス: 矢上キャンパスへのアクセスとキャンパスマップ

プログラム (11 月 24 日)

- 10:00〜11:30
  Lorenzo Cavallina 氏 (東北大学)
  Face 2-phase: how much overdetermination is enough to get symmetry in multi-phase problems.
- 11:30〜13:30
  昼食
- 13:30〜15:00
  Patrick van Meurs 氏 (金沢大学)
  Convergence of a phases-field model to a system of moving particles (P) in 1D with collisions.
- 15:00〜16:00
  休憩および討論
- 16:00〜17:30
  Norbert Požár 氏 (金沢大学)
  A rate-independent model of droplet evolution

- Lorenzo Cavallina 氏 (東北大学)

  タイトル:

  Face 2-phase: how much overdetermination is enough to get symmetry in multi-phase problems.

  アブストラクト:

  This talk is concerned with the symmetry/asymmetry properties of the solutions to an overdetermined problem that arises in the mathematical study of composite materials. We study an elliptic boundary value problem for a "two-phase" elliptic operator in divergence form where we impose homogenous Dirichlet boundary conditions. Here, the word "two-phase" stands for the fact that the coefficients of such an operator are given by a piecewise constant function that is allowed to take either one of two given values at each point. Also, we say that a level-set Γ of some function u is "overdetermined" if the norm of the gradient of u is also constant on Γ. It is known that, in the one-phase setting (i.e. where the operator is just a multiple of the Laplace operator), if the solution exhibits (at least) one overdetermined level-set, then the domain must be a ball (thus, the solutions must in turn be radial, and all level-sets are indeed overdetermined). In this talk, we show that such an elegant symmetry result does not neatly generalize to the two-phase setting, where depending on their relative positions, the existence of two overdetermined level-sets might not be enough to ensure radial symmetry. This talk is based on a joint work with Giorgio Poggesi (University of Western Australia).

- Patrick van Meurs 氏 (金沢大学)

  タイトル:

  Convergence of a phases-field model to a system of moving particles (P) in 1D with collisions.

  アブストラクト:

  We study a phases-field model (P_ε) for a system of moving particles (P) in 1D. Our aim is to show that $(P_\varepsilon) \to (P)$ as the phase-field parameter ε tends to 0. Our motivation for this is that (P_ε) is a model coming from physics, but the limiting problem (P) is much easier to solve. (P) is a system of ODEs which describe the movement of electrically charged particles by the law "velocity = force". Collisions between particles of opposite type happen in finite time. At a collision the right-hand side of the ODE blows up, which makes the analysis of it interesting. In (P_ε), the particles and their charges are characterized by phase transitions of the phase-field function v_ε on $\mathbf{R}$. v_ε satisfies a nonlocal PDE. While (P_ε) is more difficult to solve than (P), it does not blow up at collisions, and treats them in a regularized manner. Our proof method for $(P_\varepsilon) \to (P)$ relies on the comparison principle and a smart construction of sub– and supersolutions. This work is in collaboration with Stefania Patrizi, accepted to SIMA and available on ArXiv: https://arxiv.org/abs/2209.06709.

- Norbert Požár 氏 (金沢大学)

  タイトル:

  A rate-independent model of droplet evolution

  アブストラクト:

  In this talk I will introduce a simplified model of a quasistatic droplet on a surface with contact angle hysteresis based on a rate-independent evolution of the one-phase Bernoulli free boundary problem. Taking advantage of two notions of weak solutions, energy-based and comparison-principle-based, we study the dynamic contact angle of moving contact lines and the geometry of de-pinning. We show that these two notions of solutions coincide in a star-shaped setting, where we show (almost) optimal regularity of the contact line and the convergence of a minimizing movements scheme. In a general setting, the notions differ essentially in how they handle jumps, but both are shown to satisfy a weak motion law. This talk is based on joint work with Inwon Kim (UCLA) and Will Feldman (U. of Utah).