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

Einladung zur öffentlichen Defensio

Sebastian Alexander SCHAFFER

Thema der Dissertation

Physics Informed Machine Learning in the Field of Micromagnetism

Abstract:
Physics-Informed Neural Networks (PINNs) and Extreme Learning Machines (ELMs) are innovative numerical methods that embed physical laws directly into the training process. This enables flexible modeling of complex differential equations, such as the stray field problem in micromagnetism, without requiring extensive supervised data. The mathematical ideas of PINNs and ELMs are presented, which are employed for the full 3D minimization of the Gibbs free energy functional. The mesh-free models eliminate the need for complex discretization schemes and are further enhanced by a hard constraint formulation using R-functions, which ensures the precise imposition of boundary conditions within the PINN framework. Additional contributions include advanced energy minimization techniques for 3D magnetization distributions, maintaining the physical integrity of the magnetization configuration through the Cayley transform. This approach effectively models continuous magnetization distributions while minimizing total Gibbs free energy, encompassing exchange energy, anisotropy energy, and magnetostatic self-energy.

Prüfungssenat

Univ.-Prof. Mag. Dr. Andreas Cap
(Vorsitz, Universität Wien)

Univ.-Prof. Dr. Norbert Mauser
(Universität Wien)

Prof. Dr. Massimiliano d'Aquino
(Università degli Studi di Napoli Federico II)

Prof. Dr. Bruno Despres
(Laboratoire Jacques-Louis Lions Sorbonne Université)

Zeit und Ort

Freitag, 17. Jänner 2024, 15:00 Uhr

Hybrid:

Raum:

Seminarraum des WPI (Raumnr. 08.135, 8. Stock)

Online:

https://univienna.zoom.us/j/65405445489?pwd=VNlu8ESBS1IGOCifbS2YnbhiLVxkIw.1

Meeting ID: 654 0544 5489

Kenncode: 105431