Faculty of Mathematics and Economics

universität ulm

Mathematisches Kolloquium

19.01.2026 | 16:00 Coffee | 16:30 – 17:30 | Room 2.20 Heho 18

Funny things may happen when using NNs to solve PDEs

Speaker: Prof. Mark Peletier (Eindhoven University of Technology)

For many PDEs, classical simulation methods are very costly and therefore ineffective. Such classical methods include for instance finite differences, in which the solution is represented by its values on a grid, and finite elements, in which the solution is represented as a piecewise-polynomial function.

This approach has been very successful in various different contexts, and many names are associated with such methods (PINNs, VPINNs, Ga-lerkin PINNs, DeepRitz, Energy Nets, ...). At the same time, the state of the theory of such classes of functions is still very much in development. Part of the challenge is that the class of all NN functions is not a nice set: for instance, it is not linear, not convex, not smooth, and not closed. These “interesting” aspects of this class of NN functions cause other “interesting” things to happen when one tries to use NNs as approximation classes in the numerical simulation of PDEs.

In this talk I will give an example of this coming from the simulation of gradient flows such as the Allen-Cahn equation.

Joint work with Olga Mula (Vienna) and Daan Bon and Benjamin Caris (Eindhoven).