Einladung zum Oberseminar Mathematik des Maschinellen Lernens und Angewandte Analysis

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Numerical methods for PDEs in hyper graphs and networks of beams or surfaces

We introduce a general, analytical framework to express and to approximate partial differential equations (PDEs) numerically on graphs and networks of surfaces – generalized by the term hypergraphs. To this end, we consider PDEs on hypergraphs as singular limits of PDEs in networks of thin domains (such as fault planes, pipes, etc.), and we observe that (mixed) hybrid formulations offer useful tools to formulate such PDEs. Thus, our numerical framework is based on hybrid finite element methods (mainly the class of hybrid discontinuous Galerkin (HDG) methods).

In particular, we notice the beneficial properties of HDG in graphs and consider, as an example, the numerical solution of Timoshenko beam network models, comprised of Timoshenko beam equations on each edge of the network, which are coupled at the nodes of the network using rigid joint conditions. Our discretization of the beam network model achieves arbitrary orders of convergence under mesh refinement without increasing the size of the global system matrix. As a preconditioner for the typically very poorly conditioned global system matrix, we employ a two-level overlapping additive Schwarz method (if the graph is dense).

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Zu diesem Vortrag laden wir Sie herzlich ein.

gez. Leon Bungert