Karlstad Applied Analysis Seminar (2020)

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Optimal discretizations: Adaptive strategies and machine learning approaches

Abstract

In this talk I will consider two ideas underlying (quasi-)optimal discretizations of PDEs. In the classical approach, one aims to generate a sequence of approximations based on adaptive refinement of a coarse initial discretization so as to control the error in some quantity of interest. I will briefly discuss its analysis and application to nonlinear parabolic equations using an IMEX-Galerkin discretization. A new idea is to employ machine learning to train an optimal discretization on a fixed underlying mesh, whose aim is to ensure highly accurate quantities of interest regardless of the mesh size! This is achieved by the training of a provably stable parametric Petrov-Galerkin method. Some numerics will illustrate these ideas.