Structure-preserving discretizations for computing multi-physics

Douglas N. Arnold, University of Minnesota

We shall discuss the design and analysis of finite element methods for the simulation of a variety of fundamental physical systems, based on the tools and the viewpoint of finite element exterior calculus (FEEC). Often FEEC is studied in the context of linear elliptic model problems such as the Hodge Laplacian. However, one of its important strengths is its robustness and the range of its applicability. In this talk we will describe how FEEC ideas apply to more complex problems arising in various physical contexts. Examples of systems we shall discuss, which are primarily based on hyperbolic partial differential equations, include the acoustic and elastic wave equations, Maxwell's equations for electromagnetism, the equations of elastodynamics and viscoelasticity, and relativity.