Real-time PDE-constrained optimization

Abstrak

Many engineering and scientific problems in design, control, and parameter estimation can be formulated as optimization problems that are governed by partial differential equations (PDEs). The complexities of the PDEs and the requirement for rapid solution significant difficulties. A particularly challenging class of PDE-constrained optimization problems is characterized by the need for real-time solution, i.e., in time scales that are sufficiently rapid to support simulation-based decision making.
Real-Time PDE-Constrained Optimization, the first book devoted to real-time optimization for systems governed by PDEs, focuses on new formulations, methods, and algorithms needed to facilitate real-time, PDE-constrained optimization. In addition to presenting state-of-the-art algorithms and formulations, the text illustrates these algorithms with a diverse set of applications that includes problems in the areas of aerodynamics, biology, fluid dynamics, medicine, chemical processes, homeland security, and structural dynamics.
Despite difficulties, there is a pressing need to capitalize on continuing advances in computing power to develop optimization methods that will replace simple rule-based decision making with optimized decisions based on complex PDE simulations.