

SIAM/APPLIED AND NUMERICAL ANALYSIS SEMINAR

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Speaker: Anil Rao

Title: A Novel Computational Framework for the Numerical Solution of Complex Constrained Optimal Control Problems

Abstract: A novel computational framework is described for solving complex constrained nonlinear optimal control problems. The framework has a wide variety of applications in aerospace and mechanical engineering. The basis of the framework is the new class of hp-adaptive Gaussian quadrature methods that transcribe the continuous optimal control problem to a finite-dimensional nonlinear optimization problem. The hp-adaptive methods have the feature that high accuracy can be obtained with a significantly smaller mesh when compared with traditional fixed-order methods while accurately capturing nonsmoothness or rapidly changing behavior. The hp-adaptive methods employed using advanced sparse nonlinear programming (NLP) solvers. The derivatives required by the NLP solvers are obtained using a new approach to algorithmic differentiation where efficient derivative source code is produced through a method that combines operator overloading with source transformation. The mathematical foundation of the framework is provided and examples are given that demonstrate the improvement over previously developed approaches. Finally, future directions of the approach are discussed.