Advances in Algebraic Nonlinear Eigenvalue Problems

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Abstract

In this course, we will begin with essential background in computational methods for solving large scale algebraic linear eigenvalue problems, and then focus on recent progress in solving algebraic eigenvalue problems associated with matrix-valued functions which depend nonlinearly on a single scalar parameter, formally $T(\lambda) v = 0$. Advances and challenges for solving eigenvalue problems with eigenvector nonlinearity, formally $T(v) v = \lambda v$, will also be presented.

Finite Element and Enriched Finite Element Methods for Wave Problems

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Abstract

In this course, we will first consider linear elliptic (Poisson) problems and present the weak (variational) formulation and its discretization using Galerkin finite element approximations. In this setting, the essentials of enriched partition-of-unity approximations will also be introduced. Then, the focus will be on using higher-order finite elements for phononic (elastodynamic equations) and electronic (Schrodinger and radial Kohn-Sham equations) problems,which when discretized lead to algebraic nonlinear eigenvalue problems.