DK Seminar

June 22, 2016, 14:15 - 15:45
Vienna University of Technology,
Freihaus, green area, 4th floor, 101C

Martin Halla

Vienna University of Technology

Analysis of radial perfectly matched layer methods for resonance problems

We consider the approximation of resonance problems by radial perfectly matched layer (PML) methods. The methods are based on a complex scaling of the radial variable such that resonance functions become exponentially damped and the resonance problems transform to linear eigenvalue problems. As approximation the unbounded domain is truncated to a finite domain and a homogeneous Dirichlet boundary condition imposed at the artifical boundary. Due to the rapid decay of eigenfunctions the committed error is expected to be small. Consequently the resulting eigenvalue problem can be discretized by standard numerical schemes such as finite element methods. The analysis of the latter can be performed similar to classical eigenvalue problems posed on bounded domains, while the analysis of the domain truncation is typically more involved.

We propose a new concept to analyze the domain truncation based on three principles. At first we interprete the domain truncation as a conform Galerkin approximation. Secondly we utelize techniques for non-linear (more specific holomorphic) eigenvalue problems. At last we establish for operators which are not of the form "coercive+compact" a sufficient condition on the Galerkin spaces to ensure spectral convergence (including convergence rates for eigenvalues and eigenfunctions).

We apply this technique to acoustic and electromagnetic resonance problems to obtain convergence results for radial PML methods.