Title: A robust discretization technique for three dimensional Helmholtz problems

Abstract: The ability to robustly and efficiently solve Helmholtz problems has been plagued by the so-called pollution effect and the introduction of artificial resonances by the discretization. The recently developed the Hierarchical Poincare-Steklov (HPS) method has demonstrated that it does not observe either of these shortcoming for two dimensional problems. Additionally a robust coupling technique for scattering problem involving local deviations from constant coefficient which utilizes a Dirichlet-to-Neumann operator built by the HPS method has been developed. In this presentation, we will demonstrate that the extension of the HPS method to three dimensional problems is just as robust as the two dimensional solution technique. We will also present ongoing work towards making the solution technique efficient for three dimensional problems. Currently utilizing an iterative solver, the method is able to solve a mid-frequency scattering problem with variable medium to 9 digits of accuracy with a billion unknowns in 40 minutes.