THE UNIVERSITY OF CHICAGO

Computational and Applied Mathematics & Statistics Student Seminar

---

Jacob Linden

Computational and Applied Mathematics
University of Chicago

Acoustic Boundary Layers: A Boundary Integral Formulation

Wednesday, April 15, 2026
12:30 PM
DSI 103

ABSTRACT

A boundary integral formulation of the Helmholtz equation with visco-thermal boundary conditions is presented, in two dimensions. Such boundary conditions allow for the accurate simulation of viscous and thermal losses in the vicinity of the boundary, which are particularly relevant in acoustic devices with narrow features. Using cancellations between hyper-singular operators, a variant of the method of images technique, and analytic pre- conditioners, we derive integral equations that are Fredholm second-kind, up to the application of a boundedly invertible operator. We also employ Poincaré-Steklov maps to decompose the domain into separate regions, developing a solver for each and then "gluing" them together. Such domain decomposition methods are important for simulation on modular domains and geometries with multiscale features. Overall, this approach allows for the fast and accurate solution of acoustics problems with boundary layers, and is particularly relevant in the design of speakers, hearing aids, and micro-acoustic technologies.