

ADVANCES IN INTEGRAL EQUATION METHODS FOR WAVE PROPAGATION AND MULTIPHYSICS PROBLEMS

NOUR AL HASSANIEH[†], PETER NEKRASOV^{*}

[†]Flatiron Institute
162 5th Ave,
New York, NY 10010.
nalhassanieh@flatironinstitute.org (nalhassanieh.github.io)

^{*}University of Chicago
5747 S. Ellis Avenue
Chicago IL 60615
pn3@uchicago.edu (peter-nekrasov.github.io)

ABSTRACT

Boundary integral equations (BIEs) are a useful framework for reducing partial differential equations to the boundaries and interfaces of a physical domain. Though these methods result in dense matrices and typically require an explicit Green's function, recent advances in the analysis and implementation of these methods have made it easier to handle complex wave problems and incorporate new physics such as hydro-, elasto-, and electrodynamics. This session highlights these advances by bringing together recent work on both mathematical formulations of BIEs and fast computational tools for solving them. Topics include skeletonization and hierarchical compression, broadband solvers, periodic summation techniques, Maxwell waveguides, and ice-ocean interactions.

SPEAKERS

1. Fruzsina Agocs (University of Colorado, Boulder): Fast integral equation method for scattering from junctions of periodic 2D structures.
2. Travis Askham (New Jersey Institute of Technology): Adaptive integral equation methods in electrohydrodynamics.
3. Joar Bagge (KTH Royal Institute of Technology): Skeletonization-based compression for accelerating multibody scattering problems.

4. Charles Epstein (Flatiron Institute): Radiation Conditions for Maxwell Waveguide.
5. David Krantz (KTH Royal Institute of Technology): Fast periodic summation for integral equation solvers in the DMK framework.
6. Peter Nekrasov (University of Chicago): Integral equation methods for flexural-gravity waves with applications to ice floes and rifts.
7. Nilima Nigam (Simon Fraser University): The computational spectral geometry of the exterior Steklov-Helmholtz problem via layer potentials.
8. Heather Wilber (University of Washington): The fast broadband Helmholtz solver: analysis and applications.