Boğaziçi Math Seminar

Efficient time-domain scattering synthesis via frequency-domain singularity subtraction

Oscar Bruno

Caltech

Abstract:

Fourier transform-based methods enable accurate, dispersion-free simulations of time-domain scattering problems by evaluating solutions of the Helmholtz equation at a discrete set of frequencies sufficient to approximate the inverse Fourier transform. In the case of scattering by trapping obstacles, however, the Helmholtz solution exhibits nearly real complex resonances, which significantly slow the convergence of the numerical inverse transform.

To address this difficulty, the presentation describes a recently introduced frequency-domain singularity subtraction method that regularizes the integrand of the inverse transform while efficiently evaluating the singular contribution through a combination of a simple and inexpensive numerical procedure together with a large-time asymptotic expansion. Crucially, all relevant complex resonances and their residues are obtained from rational approximations of integral-equation solutions evaluated at real frequencies. An adaptive algorithm is used to ensure reliable identification of all relevant complex resonances.

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