DEPARTMENT OF MATHEMATICAL SCIENCES

Colloquium

New Forms of Canonical Forward and Inverse Waveguide Scattering Problems

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ABSTRACT: In this talk, we present a summary of mathematical methods aiming to study the properties of the scattering matrix elements as functions of the problem parameters via canonical (both forward and inverse) waveguide scattering problems. Our approach is based on application of the theory of functions of several complex variables and singularities of differentiable mappings and leads to substantial improvement of the available techniques for permittivity reconstruction of material samples in waveguides.

We also outline a proof of occurrence of singularities of the transmission coefficient in the complex domain for canonical problems in a rectangular waveguide with an arbitrary number of parallel-plane dielectric inclusions. Special analytical and numerical techniques enable us to determine, analyze and calculate the singularities. A special attention is paid to an inverse problem of determining permittivity of layered dielectrics in a waveguide of rectangular cross section. This setting becomes canonical after obtaining explicit formulas for the permittivity of a plane-parallel sample (the NRW method). The discovery of singularities of the scattering matrix suggests that practical application of the NRW technique may require additional adjustments or/and justifications.

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