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Steklov and Sloshing Eigenvalue Problems on Surfaces

The Dirichlet-to-Neumann operator of a compact Riemannian manifold M with boundary maps the Dirichlet boundary values of each harmonic function f on M to the Neumann boundary values of f. The spectrum of this operator is discrete and is called the Steklov spectrum. The Dirichlet-to-Neumann operator generalizes to the setting of orbifolds or, more generally, cone manifolds. Focusing on dimension two, we first address the question: Does the Steklov spectrum detect the presence of singularities? We then use the answer as a tool to adapt known eigenvalue bounds for the Steklov spectrum to eigenvalue bounds for mixed Steklov–Neumann problems (sometimes called sloshing problems). If time permits, we will also address the construction of Steklov isospectral manifolds in arbitrary dimension.