Abstract for East Asia Section of Inverse Problems International Association (IPIA) - 7th Young Scholar Symposium (Dec 9-10, 2023)

Some Free Boundary Methods and their Application to Inverse Scattering Problems

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In this talk, we consider the inverse scattering problem of acoustic waves, which can be modeled by the Helmholtz equation. We will focus on the non-scattering phenomena. Some of the non-scattering domain can be constructed using partial balayage [1] or the minimizing problem (with free boundary) [2]. We also discuss the possible scattering and non-scattering behavior of an anisotropic and inhomogeneous Lipschitz medium, by connecting the anisotropic non-scattering problem to a Bernuolli type free boundary problem [3].

References:

[1] Pu-Zhao Kow, Simon Larson, Mikko Salo and Henrik Shahgholian, Quadrature domains for the Helmholtz equation with applications to non-scattering phenomena, Potential Anal. (2022), early online, (doi:10.1007/s11118-022-10054-5). The results in the appendix are well-known, and the proofs can found at arXiv:2204.13934.

[2] Pu-Zhao Kow, Mikko Salo and Henrik Shahgholian, A minimization problem with free boundary and its application to inverse scattering problems, to appear in Interfaces Free Bound., arXiv:2303.12605.

[3] Pu-Zhao Kow, Mikko Salo and Henrik Shahgholian, On scattering behavior of corner domains with anisotropic inhomogeneities, arXiv:2309.11213.