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ACOUSTIC SCATTERING BY MULTIPLE SOUND-SOFT, SOUND-HARD, PENETRABLE, AND ABSORBING OBJECTS: A BOUNDARY INTEGRAL FORMULATION FOR THE DIRECT PROBLEM AND A TOPOLOGICAL ENERGY-BASED METHOD FOR THE INVERSE ONE

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ABSTRACT.

In the first part of this talk we will deal with the numerical simulation of acoustic scattering by multiple objects of different nature (penetrable, sound-soft, sound-hard, and absorbing targets) simultaneously present in the background media. We propose an indirect boundary integral formulation based on single layer potentials and analyze the resulting system.

The second part of the talk is devoted to the associated inverse problem: from measurements of the total acoustic field at a set of receptors we aim to find the shape of the objects (without knowing their nature) that produced such total field. We propose a numerical algorithm based on the computation of the topological energy of a weighted multifrequency cost functional. This topological energy allows us to generate an indicator function able to classify each point as either belonging to the background medium or to an object. We will show numerical examples that illustrate that the proposed indicator function is able to detect objects of different nature and shapes when processing noisy data for a rich enough range of frequencies.