

## **An Inverse Problem for the Helmholtz Equation Involving Two Semi-Infinite Fluids**

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An analytical method is developed for solving an inverse problem for Helmholtz's equation associated with two semi-infinite incompressible fluids of different variable refractive indices. The unknowns of the inverse problem are: (i) the refractive indices of the two fluids, (ii) the ratio of the densities of the two fluids, and (iii) the strength of the acoustic source assumed to be situated at the interface of the two fluids. The known data are the values of the acoustic pressure at the interface. The effect of the small surface tension force at the interface is also taken into account in the present work.

The proposed analytical method to solve the inverse problem is also validated against known exact solutions. In particular, exact solutions of two direct problems are first derived using standard classical methods which are then used in our proposed inverse method to recover the unknowns of the corresponding inverse problem. The results are found to be in excellent agreement.

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