

# Identification of the Mechanical Moduli of Flexible Thermoplastic Thin Films Using Reflected Ultrasonic Waves: Inverse Problem.

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## Abstract

A method for the identification of the mechanical moduli and density of flexible, supple thermoplastic thin films placed on elastic substrates using ultrasonic waves has been developed. The composite medium immersed in a fluid host medium (water) was excited using a 50 MHz transducer operating at normal incidence in reflection mode. Inverse problems involving experimental data pertaining to elastic wave propagation in the thin films on their substrates and theoretical fluid-solid interaction models for stratified media using elasticity theory were solved. Two configurations having different interface boundary conditions (BC) were modeled, transverse slip for the sliding contact interface in the case where the thin films were placed on the substrate without bonding; a bonded interface condition. The inverse problem for the recovery of the mechanical parameters were solved for the thin films under the bonded and slip BCs. Substrates made of different elastic materials having different geometries were also evaluated and their advantages discussed.

## Keywords

Thin solid flexible films Substrate Ultrasound Elasticity Layered media Inverse problem Mechanical moduli