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Identification of Acoustic Backscattering Mechanisms from Partially Exposed Elastic Spheres at an Air-Water Interface[1] AARON GUNDERSON, PHILIP MARSTON, Washington State University — Backscattered ultrasound in water from a variety of spherically shaped elastic targets breaking through an air-water interface is recorded and analyzed. The acoustic illumination is at grazing incidence. Reflected features are identified and compared to expected models in the time domain and frequency domain, developed through various techniques including ray theory, partial wave series analysis, the Kirchhoff Approximation, and complex root finding methods. Features are identified as direct target reflections, multipath reflections involving the interface, elastic target features, and surface guided waves. Comparisons between experimental and theoretical solutions indicate that Rayleigh waves (surface elastic waves) and Franz waves (diffracted surface waves) contribute greatly to the backscattering signatures of elastic spherical targets. The presence, strength, and timing of various scattering features are shown to depend on target material properties, as well as on incident acoustic frequency, target exposure in the water, and underwater viewing angle. Scattering from objects at a free surface can be used to simulate scattering from objects partially buried in smooth sand, such as the seafloor, due to their similar relative acoustic impedances.

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