DIFFRACTION CATASTROPHES IN ACOUSTICAL SCATTERING

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Wavefields associated with caustics may be classified and analyzed by applying the methods of catastrophe theory to the relevant ray singularities. Some recent examples from the scattering of high frequency sound in water will be examined. Caustics can occur when sound is reflected by naturally produced curved surfaces [1]. In one situation of interest, the backscattering of sound by small smooth objects (such as spheres) illuminated by caustic wavefields of a curved reflecting surface was measured and analyzed. The dependence of the scattering on the object's position is expressed using Airy and hyperbolic-umbilic diffraction integrals [2, 3]. When the target is in the focal region of the caustic there is a simple relationship between the arrival time, signal strength, and classification of the backscattered echo. The largest amplitude echo is doubly focused and arrives last. In other situations caustics in the farfield backscattering are the result of the focal properties of a specific target such as refraction by a penetrable cylinder [4, 5].

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