## Forward scattering of an acoustical Bessel beam by rigid structures using T-

## matrix method

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## Abstract

In this paper, forward scattering by rigid structures with nonspherical shape illuminated by an unbounded zeroth-order Bessel beam is investigated using *T*-matrix (null-field) method. Bessel beam has been proved to show several advantages over the ordinary plane wave for its superior characteristics, including nondiffraction and self-reconstruction properties, and is characterized by an important parameter, termed as half-cone angle, which describes the angle of the planar wave components of the beam relative to the beam axis. At the first time, the *T*-matrix method is combined with Bessel beam to explore the novel phenomena of acoustic scattering from complex rigid structures. The idea of *T*-matrix method is to obtain the transition matrix (T matrix) that gives a direct relationship between the known expansion coefficients of the incident waves and the unknown expansion coefficients of the scattering from rigid spheroids and cylinders with spheroidal endcaps in Bessel beams with arbitrary incidence, with particular emphasis on the aspect ratio, the half-cone angle of Bessel beam, the dimensionless frequency, as well as the angle of incidence. This research work may have some potential application in engineering practices, especially for acoustic scattering issues involving Bessel beams.

Keywords: Forward scattering, Bessel beam, T-matrix method, Complex rigid structures.