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Acoustic scattering is defined as the disturbance of a given incident sound field due to an object's shape and surface properties. The effect of scattering can be expressed in terms of a scattered sound field, which is calculated as the difference between the sound field when the object is present and the incident field without the object. The scattered sound field obeys Sommerfeld's radiation condition. Therefore its radial dependence (spherical decay) and its angular dependence can be separated in the far-field. The angular component, so-called the far-field pattern, is a complex directivity function, which is uniquely determined by the scattering object for a given incident sound field. Therefore, this quantity constitutes a good scattering measure, which includes both scattering from the surface (roughness scattering) as well as from the shape of the object (volume scattering). There are two main challenges associated to measuring the far-field pattern directly: i) it requires large distances between the object and the measurement points, and ii) the incident and the scattered fields need to be separated. In this study, we propose a method to estimate the far-field pattern via near-field pressure and particle velocity measurements. The sound field is measured on a closed arbitrary surface enclosing the object. The far-field pattern is estimated from an asymptotical formulation of the Helmholtz Integral Equation. It is possible to use either the total sound field or just the scattered part in the integral. Boundary element simulations show that the far-field patterns of different objects are correctly recovered, provided that the measurement points are less than half a wavelength apart.

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