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Subwavelength Resolution of Cracks in the Metallic Materials

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In recent years, various types of acoustic metamaterials have been proposed with capabilities for overcoming the diffraction limit. However, typically such developments only consider the acoustic regime [1] or imaging in liquid media [2]. In this paper we demonstrate the application of a holey structured metamaterial lens for sub-wavelength imaging of defects in a metallic sample, in the ultrasonic regime. Finite Element (FE) simulations are used to study longitudinal wave interaction with ideal cracks in isotropic elastic materials. Holey-structured meta-lenses are then used to transmit the scattered waves. We experimentally demonstrate a subwavelength resolution of $\lambda/7$ with a sub-wavelength notch in an aluminium block, which to the best of our knowledge this is the highest resolution achieved in the ultrasonic regime.

References:

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