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Graded Index Lens Design for Aqueous Applications[1] THEODORE MARTIN, MICHAEL NICHOLAS, GREGORY ORRIS, Naval Research Laboratory, LIANG-WU CAI, Kansas State University, DANIEL TORRENT, JOSE SANCHEZ-DEHESA, Universidad Politecnica de Valencia — A graded refractive index (GRIN) provides a means of controlling wave propagation within the bulk of a material without relying on curved interfaces between dissimilar materials. We report the design and experimental testing of a GRIN metamaterial that behaves as a lens for acoustic waves in water. The graded index is achieved using a regular array of cylindrical scatterers with an anisotropic distribution of sizes. The metamaterial lens operates at sonic frequencies and has flat interfaces. We demonstrate that this metamaterial design focuses acoustic signals in the same manner as an ideal optical lens. By comparing with calculations using multiple scattering theory and finite difference time domain methods we show that the elastic properties of the scatterers are important for achieving an accurate model of the transmitted signal. We consider perturbations of the metamaterial design and their impact on the transmission.

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