



Dr. Andrew N. Norris

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Mechanical and
Aerospace Engineering**

Rutgers University

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2:10 p.m.

1235 Howe Hall

Iowa State University

The Midwest Mechanics Seminar Series Presents
**Transformation Acoustics, Phonic Structures
and Applications**

Transformation acoustics (TA) offers the acoustical designer the potential to alter sound propagation in an exact manner that satisfies the wave equation regardless of frequency, high or low. This is the reason why TA is the foundation for exotic effects such as acoustic cloaking, which requires material properties that are anisotropic and often difficult to realize in practice.

This talk will concentrate on the special case of isotropic TA and its applications. The motivation for focusing on isotropic TA is that materials with the required properties can be readily realized by a wide variety of homogenized structures. We concentrate on underwater acoustic devices and show that quasi-phononic structures with unit cells comprising circular, square and other shaped cylinders in water provide the range of required properties. Implications are explored including the ability of conformal mappings to yield highly accurate focusing lenses. Numerical examples and data from experimental measurements will demonstrate these ideas.

As an undergraduate in Dublin, Ireland, Andrew Norris aimed for a future in physics but changed course after moving to the USA where he did his Ph.D. in Engineering Sciences and Applied Mathematics at Northwestern University. After a few years working with Exxon he moved to Rutgers University where he is now a distinguished professor of Mechanical and Aerospace Engineering. The common theme all along has been an intense interest in acoustic and elastic waves, which share the same characteristic qualities. He found that learning about seismic waves provides better understanding of acoustic phenomena, and vice versa. His current research is in acoustic and elastic meta-materials, focused on underwater applications. Acoustic meta-materials use concepts that at first sight might appear to be pushing the limits of physics, but are still feasible. A prominent example is transformation acoustics, which can lead to exotic effects such as cloaking, but is also the basis for designing accurate acoustic lenses. Dr. Norris has recently used these ideas to design and demonstrate underwater acoustic focusing devices, with help from collaborators. Dr. Norris is a Fellow of ASA, and a recipient of ASME's Per Bruel Medal and the Rayleigh Lecture Award.