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Sound dispersion in a cylindrical tube

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Physical examples are a great way to get students engaged with course content but it is not always easy to find classroom examples for senior course material. One such concept that I have been struggling with is wave modes. This concept arises naturally in mathematical physics courses and it is critical in my research area of acoustical oceanography. In searching for a classroom demonstration for dispersive waves, I happened across the idea of using the various acoustic modes that can propagate through a cylindrical pipe. In this paper, I review the background theory of sound wave propagation in a cylinder and demonstrate that you can hear the effect of the modal propagation in a classroom scale demonstration. Spectral analysis of sound recordings clearly shows the frequency cutoffs of distinct modes.

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Acoustics

Keyword-2

Modal propagation

Keyword-3

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