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Electromagnetic Analogy to Sound Propagation in Moving Media

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Abstract

An analogy is developed between the paths of sound rays in fluids undergoing shear flow and electron trajectories in magnetic fields. If the Mach number of the flow is small, and the characteristiceddy size large compared to the sound wavelength, the ray paths coincide with electron trajectories in a magneti field everywhere parallel and proportional to the vorticity vector. The ratio of the magnitude of the magnetic field to the electron momentum is determined by $e\,\mathbf{H}/Pc_0 = \psi/c$ where **H** = magnetic field, P = electron momentum, e = electron charge, c_0, c = velocities of light and sound, ψ = vorticity. Mathematically the analogy is implied by the similarity between the eikonal equation for the sound rays and the Hamilton-Jacobi equation for the electrons. Simple illustrations of the correspondence are given.

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Vortex dynamics
Acoustic wave
velocity
Acoustical properties

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