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Nonlinear Propagation of Screech Noise

Jothi Punekar and Eldad Avital
School of Engineering and Materials, Queen Mary, University of London, 327 Mile End Road, E1 4NS London, UK

This study investigates the non-linear propagation of screech noise emitted by supersonic jets. Supersonic jet noise consists of three components: mixing, broadband and screech noise. In order to generate broadband and screech noise the jet has to expand imperfectly, meaning shock waves are formed inside the potential core and interact with the surrounding shear layer. The feedback between the generated noise and the nozzle cause the screech noise pattern. It is associated with high frequency (annoying to the human ear).
Near field screech noise obtained from Large Eddy Simulation (LES) of circular supersonics jets is investigated using the Burgers equation, taking into account thermo-viscous effects. The Burgers equation is commonly used to investigate non-linear propagation effects. The initial screech signal is found to consist of two main frequency modes. Significant non-linear effects appear during propagation although the pressure amplitude is no more than a few percentages of the ambient pressure. Saw tooth waves are generated and the amplitude is found to decrease as 1/sqrt(t) for low viscous medium according to Lighthill' 'bunching' theory. Further high frequencies are also generated. Finally, geometrical attenuation is discussed by transforming the plane wave propagation to cylindrical form.