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Dissipative Effects on Propagation of the Acoustic Solitary Waves

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This paper examines dissipative effects on the acoustic solitary waves propagating in an air-filled tube with a periodic array of Helmholtz resonators connected axially. The dissipation is brought about by wall friction through boundary layers and by jet loss in resonators' throat, but the dissipation due to the diffusivity of sound is negligible. For pressure profiles measured experimentally, numerical simulations are carried out to identify the respective dissipative effects. It is revealed that the boundary layers give rise to a long tail while the jet loss yields a hump behind the peak. Although both effects decay commonly the peak pressure, they emerge prominently in the trailing behaviour of the pulse. The leading behaviour is well described locally by the solitary waves in lossless limit. Discussions are included on how the dissipative effects may be reduced to realize a pulse as closely as possible to the solitary waves.

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