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Gas Oscillations in a Closed Tube at Resonance

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Periodic gas oscillations in a closed tube are investigated experimentally and numerically. At resonance, these oscillations are accompanied by shock waves traveling back and forth along the tube. Gas temperature and pressure measurements are reported. It is found that the gas temperature changes substantially along the tube. A two-dimensional numerical model of turbulent gas oscillations is formulated and verified by comparison with experiments. It is found that the experimental data of temperature and pressure inside the resonance tube are well correlated by this model. Using the numerical model, turbulence and acoustic streaming at resonance are investigated. It is shown that the normalized pressure amplitude, as well as other flow characteristics, are functions of a single parameter, which is a combination of the acoustic Reynolds number and dimensionless tube length.

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