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Nonlinear Model of Onset of Thermoacoustic Engines DANIEL JAMES, BONNIE ANDERSON, Utah Valley University —
Thermoacoustic engines are devices that use heat to produce acoustic oscillations. Heat is applied to a heat exchanger within a resonator until an adequate temperature gradient is reached, at which point self-sustained oscillations occur. The buildup of oscillations for devices operating at a few kilohertz only last for a few seconds, but can be indicative of the performance of the device. This research uses a Van der Pol model for the self-sustained oscillations for engines operating near 1.5 kHz. Two parameters emerge from the model based on energy supplied to the system and losses of the system. LabVIEW is used to record data from different thermoacoustic engines, and fit the onset profile to a profile generated from the Van der Pol equation. A best fit of the model to the data yields quantitative comparisons of the gain and loss parameters between the engines.

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