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The nature of combustion noise: Stochastic or chaotic?[1]
VIKRANT GUPTA, None, MIN CHUL LEE, Incheon National University, LARRY K. B. LI, Hong Kong University of Science Technology — Combustion noise, which refers to irregular low-amplitude pressure oscillations, is conventionally thought to be stochastic. It has therefore been modeled using a stochastic term in the analysis of thermoacoustic systems. Recently, however, there has been a renewed interest in the validity of that stochastic assumption, with tests based on nonlinear dynamical theory giving seemingly contradictory results: some show combustion noise to be stochastic while others show it to be chaotic. In this study, we show that this contradiction arises because those tests cannot distinguish between noise amplification and chaos. We further show that although there are many similarities between noise amplification and chaos, there are also some subtle differences. It is these subtle differences, not the results of those tests, that should be the focus of analyses aimed at determining the true nature of combustion noise. Recognizing this is an important step towards improved understanding and modeling of combustion noise for the study of thermoacoustic instabilities.

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