Intrinsic thermoacoustic feedback and its consequences for combustion noise and combustion dynamics

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Abstract: Thermoacoustic combustion instabilities represent a severe challenge for the development and reliable operation of efficient, flexible and low-emission combustion technology in gas turbines and rocket engines as well as industrial or domestic burners. Traditionally, thermoacoustic modes were understood to be associated with acoustic cavity modes of the combustion system. The discovery of the intrinsic thermoacoustic (ITA) feedback loop and associated eigenmodes shattered this paradigm: the complete set of eigenmodes of a combustor is now understood to be the aggregate of acoustic and ITA modes.

In this talk I will first reminisce from a personal perspective about the studies that led to the discovery of ITA feedback and ITA modes. Then I will present the current understanding of the structure and characteristic properties of ITA modes before exploring consequences of ITA feedback, such as convective scaling of thermoacoustic eigenfrequencies, resonant amplification of combustion noise, clusters of modes in annular and can-annular combustors, and exceptional points.
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