Abstract Submitted
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Passive control and sensitivity analysis of thermo-acoustic systems via adjoint equations[1] LUCA MAGRI, MATTHEW JUNIPER, University of Cambridge — We take a technique developed for the analysis of hydrodynamic stability and adapt it to thermo-acoustic systems. We aim to determine how thermo-acoustic systems should be changed in order to extend their linearly stable region. This technique uses adjoint equations to calculate the system's sensitivity to feedback mechanisms and to changes in the base state. We investigate two thermo-acoustic systems: a Rijke tube 1) electrically heated by a hot wire and 2) heated by a compact diffusion flame. The calculation of the components of the structural sensitivity tensor reveals the passive control mechanism that has the strongest influence on both the growth rate and frequency of thermo-acoustic oscillations. We illustrate the base-state sensitivity by calculating the effects of tiny variations of the base-state parameters. The successful application of adjoint sensitivity analysis to thermo-acoustics opens up new possibilities for the passive control of thermo-acoustic oscillations by providing gradient information that can be combined with constrained optimization algorithms in order to reduce linear growth rates.

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