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An adjoint-based sensitivity analysis of thermoacoustic network models FRANCESCA SOGARO, AIMEE MORGANS, PETER SCHMID, Imperial College London — Thermoacoustic instability is a phenomenon that occurs in numerous combustion systems, from rockets to land-based gas turbines. The acoustic oscillations of these systems are of significant importance as they can result in severe vibrations, thrust oscillations, thermal stresses and mechanical loads that lead to fatigue or even failure. In this work we use a low-order network model representation of a combustor system where linear acoustics are solved together with the appropriate boundary conditions, area change jump conditions, acoustic dampers and an appropriate flame transfer function. Special emphasis is directed towards the interaction between acoustically driven instabilities and flame-intrinsic modes. Adjoint methods are used to perform a sensitivity analysis of the spectral properties of the system to changes in the parameters involved. An exchange of modal identity between acoustic and intrinsic modes will be demonstrated and analyzed. The results provide insight into the interplay between various mode types and build a quantitative foundation for the design of combustors.

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