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Nonlinear saturation of thermoacoustic oscillations in annular combustion chambers GIULIO GHIRARDO, MATTHEW JUNIPER, University of Cambridge — Continuous combustion systems such as aeroplane engines can experience self-sustained pressure oscillations, called thermoacoustic oscillations. Quite often the combustion chamber is rotationally symmetric and confined between inner and outer walls, with a fixed number of burners equispaced along the annulus, at the chamber inlet. We focus on thermoacoustic oscillations in the azimuthal direction, and discuss the nonlinear saturation of the system towards 2 types of solutions: standing waves (with velocity and pressure nodes fixed in time and in space) and spinning waves (rotating waves, in clockwise or anti-clockwise direction). We neglect the effect of the transverse velocity oscillating in the azimuthal direction in the combustion chamber, and focus the model on the nonlinear effect that the longitudinal velocity, just upstream of each burner, has on the fluctuating heat-release response in the chamber. We present a low-order analytical framework to discuss the stability of the 2 types of solutions. We discuss how the stability and amplitudes of the 2 solutions depend on: 1) the acoustic damping in the system; 2) the number of injectors equispaced in the annulus; 3) the nonlinear response of the flames.

Giulio Ghirardo
University of Cambridge

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