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Experimental investigation of the aeroacoustic coupling of
self-sustained tones to non-planar modes of a resonator

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Recent studies have shown that a jet-slot oscillator (ie, an aeroacoustic self-sustained source consisting of the impingement of the vortical structures of a plane jet on a slotted plate) can be coupled to non-planar modes of the flow-supply duct. This phenomenon occurs in the particular case where the jet-exit and the obstacle are misaligned in the spanwise direction. This paper presents an experimental investigation of the excited modes as a function of the plate inclination angle, and of the distance between the jet-exit and the slot. It is shown that: (i) the vortex-tubes spanwise morphology is governed by the nature of the transverse excited modes, and (ii) the vortices tend to impinge on the inclined obstacle almost in phase in the spanwise direction, in order to enhance the coherence of the interaction along the slot. Moreover, an elementary analytical model of the resonant acoustic field shows that the ratio between the transverse and planar modes amplitudes is tuned by the system in order to keep this coherence maximum. The existence of a so-called "opposed transverse mode" is also shown, generating vortices with an inclination angle opposed to the plate inclination angle.