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On Centrifugal Instabilities and Wake Mode in the Flow over an Open Cavity¹ GUILLAUME BRES, TIM COLONIUS, California Institute of Technology — Three-dimensional Direct Numerical Simulations of the full compressible Navier-Stokes equations are performed for open cavities that are homogeneous in the spanwise direction. The formation of oscillating spanwise structures is observed inside the cavity. This 3D instability arises from a generic centrifugal instability mechanism associated with the mean recirculating vortical flow in the downstream part of the cavity. In general, the three-dimensional mode has a spanwise wavelength of approximately the cavity depth and oscillates with a frequency an order-of-magnitude lower than 2D Rossiter (flow/acoustics) instabilities. The 3D mode properties are in excellent agreement with predictions from our previous linear stability analysis. When present, the shear-layer (Rossiter) oscillations experience a low-frequency modulation that arises from nonlinear interactions with the threedimensional mode. We connect these results with the observation of low-frequency modulations and spanwise structures in previous experimental and numerical studies on open cavity flows. Preliminary results on the connections between the 3D centrifugal instabilities and the presence/suppression of the wake mode are also presented.

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