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Exact Navier-stokes Solutions in a Compressible 2D Open Cavity Flow JAVIER OTERO, ATI SHARMA, University of Southampton, RICHARD SANDBERG, University of Melbourne — In very simple geometries and always assuming an incompressible flow, researchers have sought to understand the flow physics by looking for steady or periodic flow solutions. These solutions exactly satisfy the governing equations, and determine the physics of the flow. In the current investigation we perform for the first time this type of analysis in a compressible flow and in a complex geometry. In particular, we focus on a 2D laminar inflow open cavity flow at $Re = 2000$, which is simulated using an in-house compressible DNS code. Initially, an exact periodic flow solution is found at $M = 0.5$, which shows a novel noise generation mechanism that we explain in detail. This periodic flow solution is continued across Mach number, covering from M = 0.25 to M = 0.8. At the lower end of the range, the periodic solution ceases to exist due to the low compressibility of the system and leads to a steady state. This steady solution can be seen as the bifurcation point between the family of steady and periodic solutions.

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