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Numerical simulation of nonclassical aileron buzz over 3D unstructured adaptive meshes

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Aileron buzz refers to the self–sustained oscillations of an aileron flapping behind an aircraft wing [1]. Nonclassical buzz occurs in transonic flow regimes, and it is characterized by the oscillation of the shock wave location over–and–off the aileron surface [2]. In order to simulate this phenomenon, we couple the rigid aileron dynamics with the finite volume ALE compressible flow solver Flowmesh [3]. Dynamic grid adaptation is performed through the MMG remeshing library [4]; a local conservative procedure tracks each mesh modification in time, thus avoiding any explicit solution interpolation step, while complying with the moving boundaries and performing solution–driven adaptation.

We simulate a simplified test case, consisting of a straight wing between two walls, with a finite–span aileron. Simulations of different aileron spans highlight the 3D flow effects on the frequency of the aileron oscillations. Simulations over an alternative 2D setup, in which the aileron is still connected to the main wing by means of two flexible elements, show the influence of the air gap between aileron and wing on the shock wave movement and on the development of the self–sustained aileron oscillations.

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