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Prediction of Unsteady Transonic Buffeting using the SU2 Open-Source Code

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The transonic buffeting phenomenon, characterised by large shock oscillations, was first reported in 1940s in Ref [1]. Early experimental studies concluded that this regime is present only at specific Mach, Reynolds Numbers and triggered at incidences where shock-wave boundary layer interactions (SWBLI) are strong enough to trigger the unsteady oscillations [2], [3].

Nowadays, this phenomenon is associated with a significant drag penalty, unfavourable aeroelastic excitations and a threat to passenger safety. Although modern aircraft are designed to fly outside buffeting regimes, it is expected that for future concepts buffeting will be more likely to occur. Thus, there is an urgent need to fully understand this phenomenon and provide solutions to controlling it.

The OAT15A aerofoil has been formerly tested in the ONERA wind tunnels in Ref. [4]. The authors found that at Mach of 0.73 and Reynolds Number of 3 million, the aerofoil develops strong unsteady buffeting when taken at higher incidences. Subsequent studies in [5], [6] concluded that, although difficult, transonic buffeting could be predicted using the RANS approach although greater accuracy could be obtained by switching to higher turbulence modelling approaches such as LES [7].

This study introduces new results using the SU2 open-source code developed at Stanford University [8]. The finite-volume-method (FVM) code is used to solve the RANS equations which can be closed with SA, SA-Neg or, SST turbulence models. SU2 contains a couple of features of interest for the current work, including the ability to produce gust or plunge simulations. The intent is to investigate the prediction of unsteady transonic buffeting. Understanding this phenomenon can lead to new tests regarding its control and alleviation.

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