OVERVIEW OF UNSTEADY AERODYNAMIC APPLICATIONS IN AERONAUTICS INDUSTRY

G.Petit, F.Chalot, M.Mallet and V.Levasseur

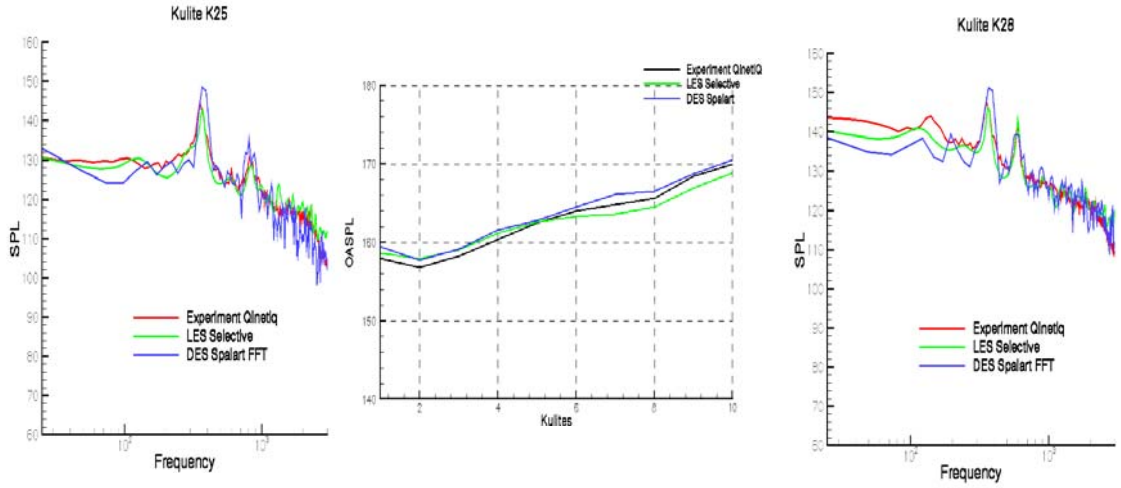
Dassault Aviation
Department of Advances Aerodynamics
78 quai M. Dassault
92124 Saint-Cloud
France

ABSTRACT

Over the last decade, Dassault Aviation has undertaken a sustained research effort to enhance its unsteady turbulent flow prediction capabilities. Research on LES subgrid models and industrial DES campaigns are both ongoing on current program or PhD theses. Current fields of interest include the predictions of aeroacoustics loads in weapons-bays and of the dynamic distortion in complex internal flows. They aim at designing low-observable aircraft. In the near future, next challenges are to compute active control features to simplify high-lift devices or enhance the mixing in after-body configurations.

Work in progress for three-dimensional Navier-Stokes ALE computations in aero-elasticity field for flutter predictions will be discussed. Euler techniques are extensively used to compute weapon release and pitching oscillations with success, however prediction are improved over the complete flight envelope for both civil and military aircraft by taking into account viscous effects such as the highly non-linear shock-induced separation in transonic region. Buffeting and associated unsteady pressure loads are also to be predicted precisely for complex three dimensional wings.

Implicit BDF2 time integration scheme coupled with a dual-time stepping algorithm enables the use of large time step which accommodates a cut in high-frequency up to 2000 Hz with reasonable computation times. Unstructured meshes are generated using an in-house software permitting the local refinement of region of interest in the flow field.



Aero-acoustic computations of the QinetiQ generic Weapon Bay Test-Case