

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Limitations of Adjoint-Based Optimization for Separated Flows J.

JAVIER OTERO, ATI SHARMA, University of Southampton, RICHARD SANDBERG, University of Melbourne — Cabin noise is generated by the transmission of turbulent pressure fluctuations through a vibrating panel and can lead to fatigue. In the present study, we model this problem by using DNS to simulate the flow separating off a backward facing step and interacting with a plate downstream of the step. An adjoint formulation of the full compressible Navier-Stokes equations with varying viscosity is used to calculate the optimal control required to minimize the fluid-structure-acoustic interaction with the plate. To achieve noise reduction, a cost function in wavenumber space is chosen to minimize the excitation of the lower structural modes of the structure. To ensure the validity of time-averaged cost functions, it is essential that the time horizon is long enough to be a representative sample of the statistical behaviour of the flow field. The results from the current study show how this scenario is not always feasible for separated flows, because the chaotic behaviour of turbulence surpasses the ability of adjoint-based methods to compute time-dependent sensitivities of the flow.

J. Javier Otero
University of Southampton

Date submitted: 31 Jul 2015

Electronic form version 1.4