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EVALUATION OF A PASSIVE CONTROL STRATEGY FOR THE DECREASE OF ACOUSTIC LOADS BEHIND BACKWARD-FACING STEPS

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Aircraft structures can be subjected to very high sound intensities (as high as over 150 dB) which can lead to acoustic fatigue and severe damages. The source of these high intensities can be for example jet engine exhaust or geometrical features such as control surfaces, flaps and cavities. Due to their severe consequences, it would be desired to predict the acoustic loads already in the design phase.

In this work, a backward-facing step is used as a model problem. The separated flow over the step induces pressure fluctuations on the floor downstream of the step. The level of these pressure fluctuations is much influenced by the break up rate of the Kelvin-Helmholtz (K-H) vortices formed at the step edge. In order to reduce the pressure fluctuations on the floor, the geometry of the step is slightly modified by adding chevrons on the step edge. The geometry with the chevrons is illustrated in Fig. 1. The purpose of the chevrons are to destabilise the K-H vortices so that they break up more quickly. Chevrons are used in a similar way to reduce the noise from jet engines, see for example [1].

The model problem is investigated using 3D Large Eddy Simulations (LES) using an incompressible solver from the OpenFOAM library [2]. The simulation methodology used in this work has been established on the backward-facing step without chevrons in [3] where good agreement was observed between the predicted and measured pressure fluctuation levels. The effect of the chevrons on the mean and r.m.s. flow field as well as on the pressure spectra will be compared with the results of the previously computed flat backward-facing step case.

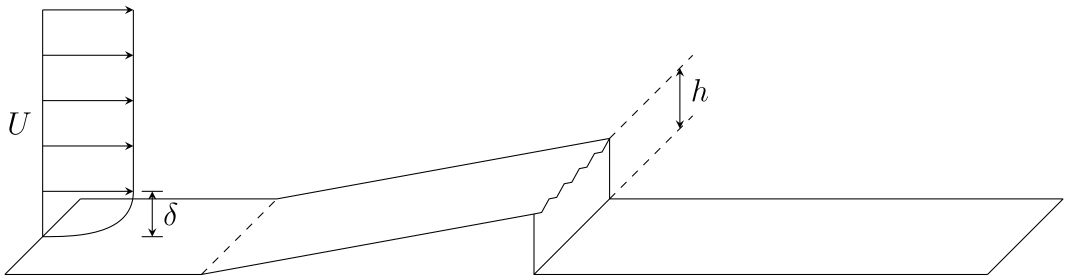

Figure 1: Model problem geometry with chevrons. Figure not to scale.

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