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Adjoint Analysis of a Compressible Channel Flow LAIA MORET-GABARRO, PATRICIA CATHALIFAUD, CHRISTOPHE AIRIAU, IMFT — We present an adjoint analysis of a compressible channel flow using Direct Numerical Simulation. The final aim of this study is to build a tool to perform control of the aerodynamic noise. The adjoint equations are derived from the 2D unsteady compressible Navier-Stokes equations, and are computed backward in time. Both systems are discretized using a 6th order compact scheme in space and 4th order Runge-Kutta scheme in time. Appropriate wall boundary conditions are derived and validated for the adjoint system. We perform sensitivity analysis by applying different kinds of forcing to the adjoint equations, where the resulting field shows the forcing of the direct system required to obtain a given effect. In this study, we are interested in finding which perturbation creates higher noise levels at the core flow (i.e. in a position far from the wall) and how to reduce it. This test case is the first step to perform adjoint analysis of more complex wall-bounded flows, and to perform optimal open-loop control to reduce noise.

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