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Dipartimento di Scienze e Tecnologie Aerospaziali

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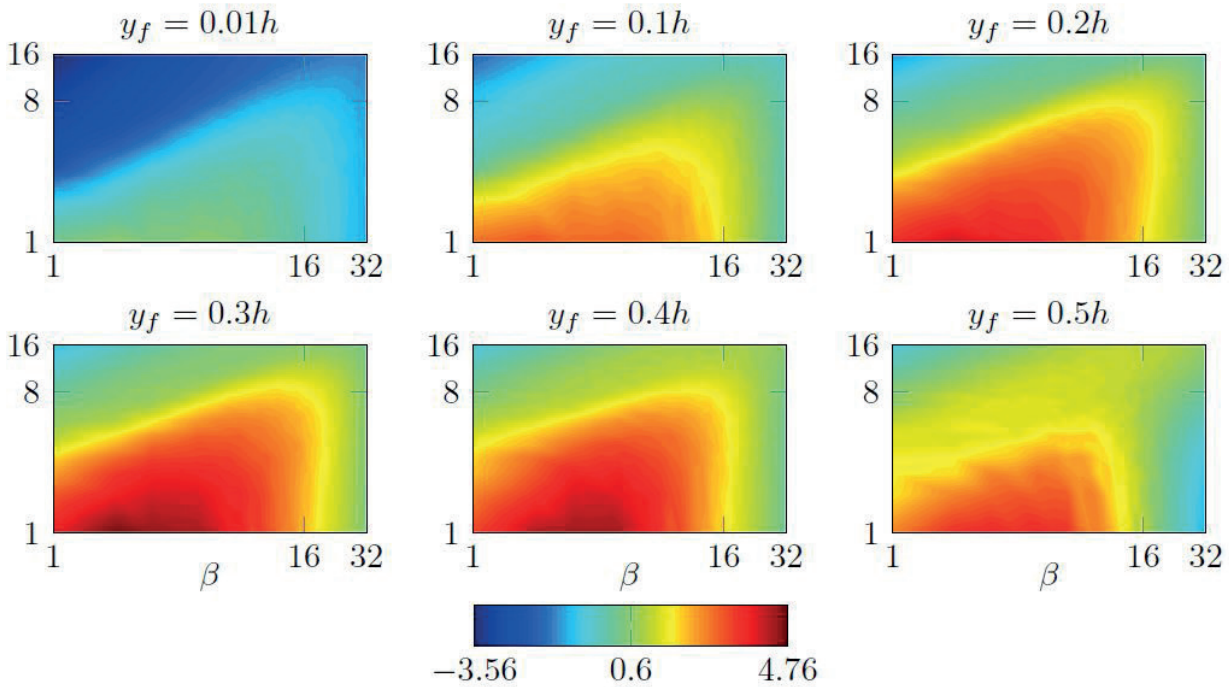

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DIPARTIMENTO DI SCIENZE E TECNOLOGIE AEROSPAZIALI

Mean Impulse Response in a Turbulent Channel Flow

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The linear response of a turbulent channel flow to an impulsive body force is measured through direct numerical simulations. The linear response can be used for many different purposes, such as the design or optimization of flow control techniques acting through body forces like plasma actuators, the understanding of how perturbations propagate in turbulent flows, or to assess turbulence models for the closure of the Reynolds-averaged Navier–Stokes equations.
Focusing on flow control applications, the impulse response is an effective tool to perform a sensitivity analysis, capable to determine in a statistical sense where and in which direction a volume force exerts its maximal influence in a turbulent flow. Moreover the time evolution of the response can also describe in detail where and at which delay the effects of the volume force affect the flow.
In this work we provide for the first time a detailed and complete space-time description of the impulse response of both laminar and turbulent flows to an impulsive volume force. Particular attention is given to the wall-normal distance at which the body force is applied, which is an important parameter in flow control applications based on plasma actuators.