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Modeling and simulation of non-homogeneous turbulence subjected to sudden distortion with finite upstream mean flow shear MOHAMMED AFSAR, IOANNIS KOKKINAKIS, SARAH STIRRAT, University of Strathclyde, THEORETICAL AND COMPUTATIONAL AERO-SCIENCE TEAM — The study of the linear evolution of turbulence with small spatial scales began with Prandtl (1933) and Taylor (1935) who analysed the distortion of unsteady flow through a contracting stream. This work was primarily motivated by ensuring optimum wind tunnel performance; i.e. that the flow in the working section downstream of a contraction has very low-intensity turbulence. It is based on the idea that the magnitude of the mean rate of strain (S) multiplied by the eddy turnover time, Teddy=Dinlet/Uinlet, is large inasmuch as S*Teddy ¡¡ 1. In this talk we perform Large-Eddy Simulations to assess the distortion of turbulence through a sudden area expansion with uniform and non-uniform inflow conditions at two different subsonic Mach numbers based on the bulk flow velocity through the contraction of 0.1 and 0.5. We find that for essentially incompressible flows (Bulk Mach number of 0.1), the initial de-correlation of the two-point velocity correlation function remains the same through the contraction. However, the subsequent temporal decay occurs more slowly for the transverse correlation function components than the streamwise component. In the talk, we discuss these properties using classical Rapid-distortion theory by solving the appropriate inhomogeneous Poisson equation.

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