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DNS of crossflow jet subject to a very strong Favorable Pressure Gradient[1] CARLOS QUINONES, GUILLERMO ARAYA, University of Puerto Rico at Mayaguez — Incompressible jets transversely issuing into a spatially-developing turbulent boundary layer (SDTBL) is one of the most challenging types of three dimensional flows due to its fluid-dynamic complexity and technological applications; for instance, film cooling of turbine blades, chimney plumes and fuel injection. In this study, Direct Numerical Simulation (DNS) of a jet in a crossflow under different streamwise pressure gradients (zero and favorable pressure gradient, hereafter ZPG and FPG) is carried out. The goal is to accurately model the interaction between the wall-normal jet with the incoming SBTBL in order to examine the physics behind the thermal coherent structures in crossflow jets at different streamwise pressure gradients (ZPG vs. FPG) and velocity ratios (VR = 0.5 and 1). The analysis is performed by prescribing accurate turbulent information (instantaneous velocity and temperature) at the inlet of a computational domain for simulations of SDTBL. The methodology is based on the Dynamic Multiscale Approach (DMA) by Araya et al. (JFM, Vol. 670, pp. 581-605, 2011). The major effect of strong FPG on crossflow jets has been identified as a rapid damping process of the counter-rotating vortex pair system (CVP) and a more quickly recovery of the skin friction coefficient.

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