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Generation of Turbulent Inlet Conditions for Thermal Boundary Layer Simulations JUAN G. ARAYA, ELAINE BOHR, KENNETH JANSEN, LUCIANO CASTILLO, Dept. of Mechanical and Aeronautical Eng.-Rensselaer Polytechnic Institute — Realistic environments generally imply spatially evolving turbulent boundary layers, being the flat plate the typical example. In this case, periodic boundary conditions cannot be established in the streamwise direction as in fully developed flows in channels. For this reason, it is necessary to generate turbulent fluctuations at the inlet of the computational domain at every time step. Lund et al. (1998) proposed an ingenious method for accounting spatial growth in the inflow condition based on the similarity of the velocity profiles at different streamwise locations. They extracted a velocity field, from a downstream plane, rescaled it and reintroduced it as a boundary condition at the inlet of the domain. In a posterior study, Kong et al. (2000) extended the previous concept to thermal inflow generation predictions. This research proposes different scales in the inner and outer regions for simulating actual turbulent temperature fluctuations at the entrance of a computational domain based on the Lund's idea: the velocity scales are based on the work of George and Castillo (1997), meanwhile the temperature scaling is derived from investigations performed by Wang and Castillo (2003). Finally, Direct Numerical Simulations of evolving turbulent thermal boundary layers on a flat plate are performed to test the proposed inflow generation model.

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