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One-dimensional Turbulence Modeling for a Heated Vertical Wall[1] HARMANJEET SHIHN[2], PAUL E. DESJARDIN[3], Department of Mechanical and Aerospace Engineering, The State University of New York, Buffalo — In this study, near-wall modeling of heat transfer from a vertically isothermal plate using a one-dimensional modeling (ODT) approach of Kerstein is investigated. The advantage of this approach is that near-wall conduction process can be treated without approximation. The effects of multi-dimensional turbulent mixing processes are modeled using a stochastic process description via triplet mapping stirring events. Adapting the ODT model to the problem of an isothermal plate includes modifying the local characteristic eddy time scale to account for the effects of buoyancy induced mixing mechanisms. Both a Lagrangian and Eulerian implementations of the ODT model are presented. Profiles of time-averaged and RMS velocity and temperature are compared to experimental data and existing self-similarity theories for thermal boundary layer along with Nusselt number predictions. Overall, very good agreement is obtained between simulation results and experimental data including the laminar-to-turbulent transition.

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