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RANS-VOF Modeling of Stratified Turbulent Flow in a Straight Rectangular Duct CHANDRIMA JANA, URMILA GHIA, University of Cincinnati, LEONID TURKEVICH, National Institute of Occupational Safety and Health — Turbulent, stratified flow of air and water in a straight rectangular duct (aspect ratio 2:1) is investigated. Turbulent flow in straight rectangular ducts exhibits secondary currents or vortices, generated by the anisotropy of the Reynolds stresses near the boundaries. Although these secondary motions are small in comparison with the streamwise motions, they influence the flow and scalar transport, and are challenging to predict accurately. Near the two-fluid interface, the turbulence structures are modified due to their interaction with the interface. The present work simulates the two-fluid flow in the duct in order to capture the structure of the secondary vortices. The turbulent flow is modeled using a Reynolds-Averaged Navier-Stokes (RANS) formulation, along with an anisotropic Reynolds Stress Model (RSM). The air-water interface is tracked using the VOF (Volume-of-Fluid) formulation. The Reynolds stresses are tracked near the solid boundaries and in the vicinity of the air-water interface. The structure of the secondary vortices in the corner formed by the interface and the solid side wall differs from that in the corner formed by the solid duct base and the solid side wall.

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