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VALIDATION ON A NEW ANISOTROPIC FOUR-PARAMETER TURBULENCE MODEL FOR LOW PRANDTL NUMBER FLUIDS

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This work aims to validate a new anisotropic four-parameter turbulence model for low-Prandtl number fluids in forced and mixed convection. Traditional models based on the gradient-diffusion hypothesis and Reynolds analogy are inadequate to simulate the turbulent heat transfer in low-Prandtl number fluids. Additional transport equations for thermal variables are required to predict the characteristic thermal time scale. In a four-parameter turbulence model, two additional transport equations are solved for the temperature variance and its dissipation rate. Thus, it is possible to formulate appropriate characteristic time scales to predict the near-wall and bulk behavior of mean and turbulent variables. The isotropic version of the four-parameter model has been widely studied and validated in forced and mixed convection. We aim to extend the model validity by proposing explicit algebraic models for the closure of Reynolds stress tensor and turbulent heat flux. For the validation of the anisotropic four-parameter turbulence model, low-Prandtl fluids are simulated in several flow configurations considering buoyancy effects and numerical results are compared with DNS data.