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Use of DNS Data for the Evaluation of Closure Models for Rotating Turbulent Channel Flow ALAN HSIEH, SEDAT BIRINGEN, ALEC KUCALA, Aerospace Engineering Sciences, University of Colorado at Boulder — A direct numerical simulation (DNS) of a turbulent channel flow rotating about the spanwise axis was conducted at a Reynolds number (based on the centerline velocity and channel half height) 8000, Prandtl number 0.71, and Rossby number 26. Several Reynolds-Averaged Navier-Stokes (RANS) based turbulence models for rotating flows were analyzed and tested. It was shown that the closure approximations in the pressure-strain correlation term proposed by the Speziale, Sarkar, and Gatski (SSG) RSM model were more accurate than the Girimaji EARSM model. The Reynolds stresses, primarily the shear stresses, produced by the Girimaji model were compared to the DNS data and revealed an evident discontinuity in the modeled Reynolds stress profiles; consequently, a smoothing function was generated and applied as a correction so that there is significantly better agreement between the Reynolds shear stress profiles produced by the DNS data and the modified Girimaji model.

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