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A single-point model from SO(3) decomposition of the axisymmetric mean-flow coupled two-point equations TIMOTHY CLARK, Department of Mechanical Engineering, University of New Mexico, Albuquerque NM, ROBERT RUBINSTEIN, Computational Aerosciences Branch, NASA Langley Research Center, Hampton VA, SUSAN KURIEN, Theoretical Division, Los Alamos National Laboratory, Los Alamos NM — The fluctuating-pressure-strain correlations present a significant challenge for engineering turbulence models. For incompressible flow, the pressure is an intrinsically two-point quantity (represented as Green's function, integrated over the field), and therefore representing the implied scale-dependence in a one-point model is difficult. The pioneering work of Launder, Reece and Rodi (1975) presented a model that satisfied the tensor symmetries and dimensional consistency with the underlying Green's function solution, and described the assumptions embedded in their one-point model. Among the constraints of such a model is its inability to capture scale-dependent anisotropic flow development. Restricting our attention to the case of axisymmetric mean-field strains, we present a one-point model of the mean-flow couplings, including the pressure-strain terms, starting from a directional (tensorially isotropic) and polarization (tensorially anisotropic and trace-free) representation of the two-point correlation equations, truncated to the lowest order terms. The model results are then compared to simulations performed using arbitrary orders of spherical harmonic functions from which the exact solution may be obtained to desired accuracy.

Susan Kurien
Theoretical Division, Los Alamos National Laboratory, Los Alamos NM

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