

Abstract Submitted
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Normalized Reynolds Stress Closure CHARLES PETTY, ANDRE BENARD, Michigan State University — The Reynolds Averaged Navier-Stokes (RANS-) equation together with a closure model for the Reynolds stress govern the mean velocity field of a Newtonian fluid in inertial and in non-inertial frames. Mixing and production of the turbulent kinetic energy and the turbulent dissipation depend on the Reynolds stress and the Cauchy stress. Over the past 143 years, J. Boussinesq and many others have assumed that the Reynolds stress and the Cauchy stress are both frame insensitive. Unfortunately, multiple versions of the eddy viscosity model are still being used to regress experimental data. It is noteworthy that the Coriolis Theorem associated with equivalent motions predicts that the strain rate is frame insensitive; and, the normalized Reynolds stress is frame sensitive. This presentation will review the underlying physical and mathematical principles that define the Cauchy stress and the Reynolds stress. The impact of the Coriolis acceleration on the anisotropy of the turbulent kinetic energy cascade for homogeneous decay was unexpected.

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