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Transition Modeling for the Taylor-Green Vortex DANIEL ISRAEL, Los Alamos Natl Lab — The exact moment equations that form the basis for most turbulence models are equally valid for non-turbulent flow. Here we are interested in predicting transition of the Taylor-Green vortex (TGV). Conventional $k-\varepsilon$ closures include only a destruction term in the dissipation rate equation. However, the transition of the initial delta function spectrum to a broad turbulent spectrum appears as a production of dissipation. The exact dissipation rate equation, $\dot{\varepsilon} = -\frac{\varepsilon^2}{k}\left(\frac{7}{3\sqrt{15}}SR_t^{1/2} + \frac{7}{15}G\right)$, studied extensively by Speziale Bernard (1992) and Ristorcelli (2003), can have both production and destruction. It turns out that even very simple closures for S and G, namely, setting both to constants, results in qualitatively correct predictions for the TGV transition. Direct numerical simulation data from the entire family of TGV initial conditions further casts light on the role of anisotropy in the transition process, as well as the broader promise and limits of transition modeling.

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