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Representing the inhomogenous two-point second-order velocity correlation[1] AMITABH BHATTACHARYA, University of Pittsburgh, ROBERT MOSER, The University of Texas, Austin — Knowledge of a finite-dimensional representation for the velocity correlation tensor $R_{ij}(\mathbf{x},\mathbf{r}) = \langle \mathbf{u_i'}(\mathbf{x}-\mathbf{r/2})\mathbf{u_j'}(\mathbf{x}+\mathbf{r/2})\rangle$ can be useful for extracting the correlation from finite-dimensional filtered LES correlation. Previously (Bhattacharya *et al* 2008), a structure-tensor based model for $R_{ij}(\mathbf{x},\mathbf{r})$, homogeneous in $\mathbf{x}$, has been shown to agree well with data from channel flow for the normal ($i = j$) components. However, this homogeneous model does not represent the shear ($i \neq j$) components well, due to the antisymmetric-in-$\mathbf{r}$ part of the correlation arising because of inhomogeneity. In this work, we formulate an inhomogeneous representation that is also based on structure tensors, satisfies the inhomogeneous continuity equation, and satisfies some additional consistency conditions. The inhomogeneity is expressed in terms of variation in $\mathbf{x}$ of both the integral length scale of the correlation and the velocity scale. We fit our model to correlations from DNS of turbulent channel flow and report these variations, as well as the improvements seen in the quality of the fit when compared to the homogeneous model.

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