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A neural-network-based subgrid-scale model for LES of turbulent channel flow[1] JONGHWAN PARK, HAECHEON CHOI, Seoul National University — A neural-network-based subgrid-scale model is developed for a turbulent channel flow at $Re_\tau = 180$, and *a priori* and *a posteriori* tests are conducted to investigate the prediction performance of this neural network (NN). In *a priori* test, an NN-based subgrid-scale (SGS) model with stencils of strain rate or velocity gradient tensor as the input variable provides highest correlation coefficients between the true and predicted SGS stresses. However, these NN models also provide the backscatter, incurring the numerical instability in the actual LES. On the other hand, an NN-based SGS model with a single point of the strain rate tensor as the input shows an excellent prediction performance for the turbulence statistics such as the mean velocity profile and the Reynolds shear stress. The present NN model is applied to a higher Reynolds number ($Re_\tau = 720$) with the model trained at $Re_\tau = 180$. The results also show good agreements with those of filtered DNS data. When the grid resolutions are different from that of training data, the NN-based SGS model does not work well in LES. This problem is overcome by training the NN with the database obtained with two different filters whose sizes are larger and smaller than the grid sizes used in LES.

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