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Going beyond eddy viscosity: Finding a general representation of subgrid-scale stresses in large-eddy simulation

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Abstract In the current study we aim to go beyond the dissipative description of turbulent flows that is provided by eddy viscosity models for large-eddy simulation. As a starting point, we consider a general subgrid-scale model that is nonlinear in the velocity gradient. To reduce the number of degrees of freedom of the model, we propose a first-principles-based procedure to find a minimal representation of subgrid-scale stresses. Then, several criteria to determine the dependence of model coefficients on flow properties are detailed. Ultimately, this would lead to a better understanding of the role of different nonlinear model terms in the description of turbulent flows.

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