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Large-eddy simulations based on the subgrid-scale kinetic energy transport equation JOSE FERNANDES PEREIRA, CARLOS B. DA SILVA, IST/IDMEC Technical University of Lisbon, Portugal — This presentation focusses on the development of SGS models based on transport equations for the SGS kinetic energy and SGS scalar variance. These models do not suffer from the limitations of the local equilibrium assumption that is used by the great majority of existing SGS models. In virtually all SGS models using transport equations, the diffusion terms are lumped together, and their joint effect is modeled using a "gradient-diffusion" model. It is shown that this is a poor approximation for inertial range filter sizes and high Reynolds numbers. The reason for this lies in a loss of local balance between the SGS turbulent diffusion and diffusion caused by GS/SGS interactions, and in the deficient modeling of the diffusion by SGS pressure-velocity interactions. In order to improve this situation, a new model, inspired by Clark's SGS model, is developed for this term. The new model shows very good agreement with the exact SGS pressure-velocity term in a priori tests and better results than the classical model in a posteriori LES tests. We assess several models currently used for the molecular/viscous SGS dissipation terms. The model used in hybrid RANS/LES tested here gives very poor results. The reason behind this is connected with the deficient spectral representation of the exact molecular SGS dissipation term.

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