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An alternative eddy-viscosity representation and its implication to turbulence modeling SUAD JAKIRLIC, Darmstadt University of Technology, Germany, JOVAN JOVANOVIC, Friedrich-Alexander University of Erlangen-Nuremberg, Germany, BRANISLAV BASARA, Advanced Simulation Technologies, AVL List GmbH Graz, Austria — Large majority of turbulence models in the RANS framework (it holds also in the case of the LES method) is based on the eddy-viscosity rationale. The principle task of modeling the Reynolds stress tensor reduces to modeling the eddy-viscosity, representing, according to Boussinesq (1877), the "coefficient of proportionality" between the Reynolds stress and mean rate of strain tensors. In the present contribution an extended formulation based on the least square approach applied to the Boussinesq's correlation is presented. Furthermore, a Taylor-microscale-based formulation is derived originating from the equilibrium assumption related to the equality between the production and dissipation rates of kinetic energy of turbulence. Finally, an expression is proposed reflecting the Reynolds stress anisotropy influence on the eddy-viscosity damping by approaching the solid wall as well as including an appropriate length-scale switch accounting for the viscosity effects through inclusion of the Kolmogorov scales blended with those of the energy-containing eddies. The latter formulation is successfully applied in the framework of an instability-sensitive Reynolds stress model of turbulence. The afore-mentioned eddy-viscosity definitions are comparatively assessed in a series of wall-bounded flow configurations (including separation) in a Reynolds number range.

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