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A LES-Langevin model for turbulence ROSTISLAV DOLGANOV, BÉRENGÈRE DUBRULLE, Turbulence Modeling, JEAN-PHILIPPE LAVAL, Turbulence Simulations — The rationale for Large Eddy Simulation is rooted in our inability to handle all degrees of freedom ($N \sim 10^{16}$ for $Re \sim 10^7$). "Deterministic" models based on eddy-viscosity seek to reproduce the intensification of the energy transport. However, they fail to reproduce backward energy transfer (backscatter) from small to large scale, which is an essentiel feature of the turbulence near wall or in boundary layer. To capture this backscatter, "stochastic" strategies have been developed. In the present talk, we shall discuss such a strategy, based on a Rapid Distorsion Theory (RDT). Specifically, we first divide the small scale contribution to the Reynolds Stress Tensor in two parts: a turbulent viscosity and the pseudo-Lamb vector, representing the nonlinear cross terms of resolved and sub-grid scales. We then estimate the dynamics of small-scale motion by the RDT applied to Navier-Stockes equation. We use this to model the cross term evolution by a Langevin equation, in which the random force is provided by sub-grid pressure terms. Our LES model is thus made of a truncated Navier-Stockes equation including the turbulent force and a generalized Langevin equation for the latter, integrated on a twice-finer grid. The backscatter is automatically included in our stochastic model of the pseudo-Lamb vector. We apply this model to the case of homogeneous isotropic turbulence and turbulent channel flow.

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