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A New Formulation For Coupling Turbulence in Hybrid LES-RANS Techniques STEPHEN WOODRUFF, Computational AeroSciences Branch, NASA Langley Research Center — In order for the full potential of hybrid Large-Eddy Simulation (LES) - Reynolds-Averaged Navier-Stokes (RANS) computations to be realized, the turbulence in the RANS and LES regions must be coupled, permitting RANS-LES transitions to be set according to the physics of the problem rather than the requirements of the method. A formulation for doing this is proposed which clarifies the relationship between quantities computed from blended models and physical variables when the numerical resolution is varied from that of RANS to that of LES. This understanding may then be employed to show how the governing equations themselves must be modified in order to maintain physical validity when resolution varies. The formulation thus permits accuracy to be maintained throughout LES-RANS transitions, regardless of where they are placed, and all turbulence dynamics are consequently coupled between LES and RANS subdomains. The effectiveness of this formulation is demonstrated in hybrid simulations of plane channel flow, with the LES-RANS transition placed in the log layer. The unphysical shift in the log layer is largely eliminated, at the cost of some additional computation. Prospects for further improvements in accuracy and efficiency are discussed.

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