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QUALITY ASSESSMENT OF LARGE EDDY SIMULATION APPLIED TO TRIPLE PARALLEL JETS

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Large Eddy Simulation (LES) consists in explicitely resolving the largest turbulent scales while the small-scale motions are taken into account by means of a subgrid-scale (SGS) model. Although it remains computationally expensive, LES seems to constitute an increasingly employed tool for engineering applications in fluid mechanics. In order to evaluate the quality of LES using the CEA in-house code TrioCFD, a Verification and Validation study is proposed. Based on a previous work [1], several LES of triple parallel jets are conducted with various grid sizes and SGS models. Following the idea of Celik [2], we look for the effective SGS kinetic energy under the form $k_{sgs} = a\Delta^p + b\Delta^q$, where Δ is the grid size, p the order of the numerical scheme and q the order of the subgrid-scale model. Such a formulation allows to discriminate between the effect of numerical error and modeling error. Theoretically, five calculations are needed to estimate the values of the parameters in the above model, but the computational cost is very high. In the present work, the methodology for Verification is divided in two steps. In a first part, no SGS model is set and two different calculations yield the SGS kinetic energy in function of the order p. Then, a SGS model is added and its order of convergence q is calculated using two other simulations. Then, one can assess the quality of various SGS models, such as Smagorinsky and WALE. Finally, a Validation of the results is conducted by comparing the computed velocity profiles to the experiments of the Japan Atomic Energy Agency [3]. The effects of grid resolution, SGS model and boundary conditions are discussed.

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