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ADVANCED MODELS FOR LARGE-EDDY SIMULATION AND REGULARIZATION OF TURBULENT FLOWS

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ABSTRACT

The main objective of the proposed Minisymposium is to bring together people working on advanced, cutting-edge methods for both large-eddy simulation (LES) and regularization models for turbulent flows. Both techniques aim to reduce the dynamical complexity of the original Navier-Stokes (NS) equations resulting into a new set of PDE that are more amenable to be numerically solved on a coarse mesh. Despite they are formally derived from different principles, they share many features and fundamental issues. The proposed minisymposium focusses on approaches that preserve some properties of the Navier-Stokes equations exactly.

Regularization methods basically alter the convective term to reduce the production of small scales of motion. The first outstanding approach in this direction goes back to Leray [1]. Other regularization models have also been proposed and tested in the last decade [2-5]. Although the underlying idea remains the same, the list of properties of the NS equations that are exactly preserved differs. On the other hand, LES equations result from filtering the NS equations in space. The effect of the under-resolved scales is then given by the subgrid stress (SGS) tensor that depends on both the filtered and the unfiltered velocity. Then, the famous closure problem in LES basically consists on approximating the unknown SGS tensor with a tensor in terms of the (resolved) filtered velocity.

Nowadays, it is generally accepted that a turbulence model should fullfill a list of desirable properties corresponding to different flow configurations. Among others, it should switch off for laminar flows and for fine enough mesh resolutions. Moreover, the model should also automatically vanish near solid walls. Hence, ideally models should be based on differential operators that satisfy this list of properties *per se*. In this context, several eddy-viscosity models for LES have been proposed in the last years [6-11]. The same ideas have also been applied to regularization methods. In the proposed Minisymposium, results illustrating the potential of new, advanced methods for both techniques will be presented and discussed.

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