14th World Congress on Computational Mechanics (WCCM XIV)
8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)
July 19–24, 2019, Paris, France

ADVANCED TECHNIQUES FOR LARGE-EDDY SIMULATION OF TURBULENCE IN NEAR-WALL REGIONS
TRACK 600

ROEL VERSTAPPEN[*], F. XAVIER TRIAS[⋆] AND ALEXEY DUBEN[†]

[*] Johann Bernoulli Institute for Mathematics and Computer Science, University of Groningen
P.O. Box 407, 9700 AK Groningen, The Netherlands. E-mail: r.w.c.p.verstappen@rug.nl

[⋆] Heat and Mass Transfer Technological Center, Technical University of Catalonia
c/Colom 11, 08222 Terrassa (Barcelona). E-mail: xavi@cttc.upc.edu

[†] Keldysh Institute of Applied Mathematics
4A, Miusskaya Sq., Moscow 125047, Russia. E-mail: aduben@keldysh.ru

Key words: Large-Eddy Simulation, Wall-modeling, Detached-Eddy Simulation, Turbulence

ABSTRACT

The Navier-Stokes (NS) equations are an excellent mathematical model for turbulence. Unfortunately, most of practical turbulent flows cannot be computed directly from the NS equations because not enough resolution is available to resolve all relevant scales of motion. Therefore, numerical simulations have to resort to turbulence modeling. We may therefore turn to large-eddy simulation (LES) to predict the large-scale behavior of turbulent flows. In LES, the large scales of motions in a flow are explicitly computed, whereas effects of small-scale motions are modeled. Since the advent of CFD many subgrid-scale (SGS) models have been proposed and successfully applied to a wide range of flows. Most of the difficulties in LES are then associated with the presence of walls where SGS activity tends to vanish. Therefore, apart from many other relevant properties, LES models should properly capture this feature [1, 2]. This implies an accurate resolution of the near-wall region which results on an (extremely) high computational cost at high Reynolds numbers. Hence, in the foreseeable future, the feasibility of LES simulations will have to rely on specific near-wall region modelization techniques [3, 4]. In this context, the objective of this Minisymposium is to bring together people working on advanced, cutting-edge methods for LES of turbulent flows with special emphasis to wall-bounded problems and unsteady separated flows at high Reynolds numbers where a higher degree of modelization (*e.g.* DES, wall-modeled LES) is required.

REFERENCES

[1] W. Rozema, H. J. Bae, P. Moin, and R. Verstappen. Minimum-dissipation models for large-eddy simulation. *Physics of Fluids*, 27:085107, 2015.

[2] F. X. Trias, D. Folch, A. Gorobets, and A. Oliva. Building proper invariants for eddy-viscosity subgrid-scale models. *Physics of Fluids*, 27(6):065103, 2015.

[3] P. R. Spalart. Detached-eddy simulation. *Annual Review of Fluid Mechanics*, 41:181–202, 2009.

[4] J. Larsson, S. Kawai, J. Bodart, and I.Bermejo-Moreno. Large-eddy simulation with modeled wall-stress: recent progress and future directions. *Mechanical Engineering Reviews*, 3:1–23, 2015.