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AN EFFICIENT TWO LAYER WALL MODEL FOR HIGH REYNOLDS NUMBER LARGE EDDY SIMULATION

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Wall bounded flows at high Reynolds number are of great interest since they are present in a wide range of important industrial applications. However, accurate numerical simulation methodologies such as Large Eddy Simulation (LES) are still too expensive to be used routinely in the industry for this type of flows. Wall-Modeled LES is intended to circumvent the huge costs of resolving accurately the boundary layer while taking advantage of the temporal and spatial accuracy of a LES computation. In this work, a Two Layer Model (TLM) in which the full incompressible Reynolds Average Navier Stokes equations are used as the wall layer governing equations is presented. The TLM are affected by two recurrent problems, the "log-layer mismatch" and the resolved Reynolds stresses inflow. Until now, computationally expensive strategies have been proposed to deal with both issues separately[1, 2]. In this work, a time-averaging filter that tackles the two problems at once with a single and low-computational-cost step is used for the first time in the TLM context, improving dramatically the wall model performance. The present wall model has been tested with both, equilibrium and non-equilibrium flows such as a pipe flow case at $Re_\tau = 3000$ and a DU 91-W2-250 airfoil at $Re = 3 \times 10^6$ and full stall, obtaining good numerical results in all operating conditions as shown in Figure 1.

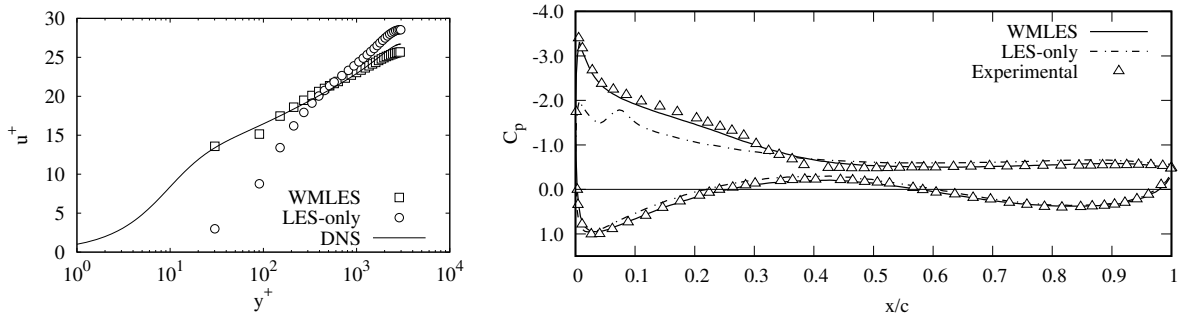

Figure 1: Numerical results of a WMLES pipe flow at $Re_\tau = 3000$ (left) and a DU 91-W2-250 airfoil at $Re = 3 \times 10^6$ and at angle of attack 15.2° (right)

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