PSEUDO-DIRECT NUMERICAL SIMULATION (P-DNS) AS APPLIED TO THE SOLUTION OF DEVELOPING FLOWS

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Keywords: multiscale, P-DNS, turbulence, boundary layer.

Abstract. Flow regions near solid surfaces are called boundary layers and require special treatment for several reasons. The behavior of the flow in these zones results from the balance between diffusive and convective phenomena. The proximity of the wall, on the other hand, significantly affects the velocity profile, which shows steep gradients even in the laminar case, and greatly controls the turbulent scales that may appear. The novel methodology called Pseudo-Direct Numerical Simulation (P-DNS), which separates the fields to be resolved into two space-time scales called coarse and fine, has been used successfully so far in problems where the effects of solid walls were not significant or in flows that were already developed. In this work we present the first efforts to extend its scope to problems where the interaction of the flow with the walls is the predominant phenomenon, particularly in cases with developing boundary layers. The P-DNS method and strategies for modeling boundary layer growth and computation of associated wall stresses are briefly described. Results are presented on simple developing flow problems, analyzing the effectiveness of the method and exploring possible opportunities for improvement.