Asociación Argentina
de Mecánica Computacional

Resúmenes de Mecánica Computacional Vol I, pp. 63-63
C.I. Pairetti, M.A. Pucheta, M.A. Storti, C.M. Venier (Eds.)
H. Castro, J. D'Elía, L. Battaglia, M. Coussirat, S. Sarraf, A. Scarabino (Issue eds.)
Rosario, November 5-8, 2024

STRUGGLING WITH THE MODELING OF BOUNDARY LAYERS IN COARSE GRIDS WITH THE PSEUDO-DIRECT NUMERICAL SIMULATION METHOD (P-DNS)

Axel E. Larreteguy[a], Francisco M. Sívori[e], Juan M. Gimenez[b,c], Norberto M. Nigro[c] and Sergio R. Idelsohn[b,d]

[a]*Instituto de Tecnología, Universidad Argentina de la Empresa (UADE), Lima 775, (C1073AAO) Buenos Aires, Argentina, alarreteguy@uade.edu.ar*

[b]*Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE), Barcelona, Spain*

[c]*Centro de Investigación de Métodos Computacionales (CIMEC), Santa Fe, Argentina*

[d]*Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain*

[e]*Instituto de Tecnología, Universidad Argentina de la Empresa (UADE, CONICET), Buenos Aires, Argentina*

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

Abstract. Flow regions near solid surfaces are strongly dominated by viscosity effects and greatly affected by the near-wall pressure field. The velocity profiles are far from linear and the associated furbulence level and characteristics vary very rapidly in directions normal to the solid boundaries. The novel methodology called Pseudo-Direct Numerical Simulation (P-DNS) is intended to simulate laminar and turbulent flows using meshes too coarse to be deemed adequate for other, more traditional, methodologies (e.g. those of the RANS and LES families). P-DNS is a novel multiscale methodology which separates the fields to be resolved into two space-time scales called coarse and fine, being the limit between scales in principle arbitrary. The freedom in selecting this limit allows for P-DNS to be used both in applications which require less detailed but faster answers and also in those requiring greater accuracy. P-DNS has been so far successfully used mainly in problems where the effects of solid walls were not significant and, in some cases, in fully developed pipe flows. Applying the methodology to problems with more complex (i.e. curved) solid boundaries with meshes so coarse that they are barely able to even describe its geometry, has proven to be a challenging task. This work briefly describes the main characteristics of the turbulent boundary, including the effect of the local pressure gradient, and covers some of the solutions explored to simulate these layers in the P-DNS framework.

ISSN: 3072-7723 DOI: 10.70567/rmc.v41i7.159