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# PDNS: A NOVEL TURBULENCE MODEL SUITABLE FOR COARSE MESHES APPLIED TO FLOWS WITH STRONG PRESSURE GRADIENTS AROUND AIRFOILS

**Francisco M. Sívori[a], Axel E. Larreteguy[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, CONICET), Buenos Aires, Argentina, fmsivori@gmail.com*

[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), Buenos Aires, Argentina*

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**Abstract.** Turbulence models require specific considerations for regions near solid walls due to the presence of boundary layers. Achieving accurate estimations of wall shear stress require a sufficiently refined mesh capable of capturing the laminar sublayer, a requirement often unattainable in many industrial simulations. In this sense, some models resort to ad-hoc wall laws in order to lower these requirements. Moreover, the presence of strong pressure gradients, like those found near the leading edge of wing profiles, also impose refinement requirements, leading to meshes fine enough to adequately represent the pressure field. These meshes are, however, too coarse for the most widely used turbulence models to be applicable. The Pseudo-Direct Numerical Simulation Method (P-DNS) is a novel turbulent model that does not require such fine meshes to adequately predict skin friction, being amenable to be used in meshes as coarse as those required to properly represent the pressure field. It is not based on the Boussinesq hipothesis and does not rely on the concept of a turbulent viscosity, unlike most of the traditional turbulence models. This work presents highly promising results in airfoil simulations. Specifically, simulations of a NACA0012 profile at different angles of attack are presented and compared to NASA simulations and experimental results.


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