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Comparison of LES and PANS calculations with available DNS data for the flow past a square cylinder BRANISLAV BASARA, ZORAN PAVLOVIC, AVL List GmbH — The recent Direct Numerical Simulation (DNS) data of Trias et al. (2015) for the flow around a square cylinder at Re=22000 was used to assess the accuracy of Large Eddy Simulation (LES) and Partially-Averaged Navier-Stokes (PANS) calculations. The triple decomposition of the velocity into the mean, coherent and stochastic components allows useful and detailed analysis of calculation results. This is of a special interest for PANS calculations, which usually use efficient but inadequate treatments for the main model resolution parameter. This issue may get pronounced in a strong vortex shedding flow as presented in this work. Namely, the unresolved to total kinetic energy ratio known as the resolution parameter, is obtained from the grid spacing and the integral length scale of turbulence, which is usually calculated by summing up unresolved turbulent kinetic energy obtained from its own equation and the resolved kinetic energy calculated as a difference between the instantaneous and averaged velocity. Consequently, such summation procedure includes coherent and stochastic parts possible leading to higher integral length scales and too low values of the resolution parameter. An assessment of this deficiency by using DNS data as well as by comparing to LES calculations results is essential for further PANS modelling improvements. This work will assess the recent proposals for the calculation of the resolution parameter including one proposed by Basara and Girimaji (2013), which was related to the solution of the modelled resolved kinetic energy equation and thus avoiding the long and expensive flow averaging.

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