Vorticity Modeling For The Flow Over Surface-Mounted Prisms

Lihai Qin

ABSTRACT

Vorticity modeling is used to simulate the flow around a surface-mounted prism. The objective is to examine whether vorticity modeling can give satisfactory information about surface pressure fluctuations which are mostly due to the outer or inviscid flow. Differences between results obtained with vorticity modeling and what one should expect from DNS and LES are pointed out. These include the difference between the governing equations, the shortcomings of having a 2-D simulation and the realization of introducing and convecting vorticity to simulate some turbulence aspects. All necessary details needed for the setup of vorticity modeling for complex flows, such as the one considered here are given. These details include choice of elements, the calculation of velocities, the application of boundary conditions and calculation of pressure. The numerical procedure and our use of parallelization in the code are explained. The results presented on velocity magnitude, vorticity and pressure show important characteristics of the flow field in terms of interaction of positive and negative vorticities and their effects on the surface pressure. The calculated peak and mean values for the pressure coefficients at the leading edge are close to those measured in separating flows over prisms.