Assessment of Various Low-Reynolds Number Turbulence Models for Recirculating Flow Computation

楊一龍,陳炳煌
Mechanical Engineering
Engineering
yylung@chu.edu.tw

Abstract

The periodic vortex shedding past a cylinder is presented. The solution at low Reynolds number was used to check the accuracy of the program. At Re=1.54, the streamlines agree very well with experiment without any separation around the cylinder. At Re=28.4, the separation point and the length of the wake matches the experiment with symmetric separation at the trailing edge of the cylinder. At Re=1000, the numerical solution becomes un-symmetric at the downstream of the cylinder. The finer the mesh, the larger iterations are required to reach the periodic vortex shedding. The streamlines of the current solution are compared well with Arnone's result. The accuracy of the Strouhal number depends strongly on the time step used. Wilcox's high and low Reynolds number $\kappa-\omega$ models, Jones-Launder $\kappa-\varepsilon$ model and Launder-Sharma $\kappa-\varepsilon$ model were used to study the structure of the shedding vortex. The high Reynolds number $\kappa-\omega$ model gives the biggest eddy viscosity among these turbulent models. On the other hands, the Jones-Launder $\kappa-\varepsilon$ model provides the highest resolution on the wake structure among these turbulent models.

Keyword：Strouhal number, turbulence models