

عنوان مقاله:

Direct Numerical Simulation of the Wake Flow Behind a Cylinder Using Random Vortex Method in Medium to High Reynolds Numbers

محل انتشار:

ماهنامه بین المللی مهندسی، دوره 13، شماره 3 (سال: 1379)

تعداد صفحات اصل مقاله: 18

نویسندگان:

Ghassem Heidarinejad - *Mechanical Engineering, Tarbiat Modares University*

S. Delfani - , *Tarbiat Modarres University*

خلاصه مقاله:

Direct numerical simulation of turbulent flow behind a cylinder, wake flow, using the random vortex method for an incompressible fluid in two dimensions is presented. In the random vortex method, the primary variable is vorticity of the flow field. After generation on the cylinder wall, it is followed in two fractional time step in a Lagrangian system of coordinates, namely convection and diffusion. No closure model is used and the instantaneous results are calculated without any a priori modeling. Regarding the Lagrangian nature of the method, there is a very good compatibility between the numerical method and physics of the flow. The numerical results are presented for a wide range of Reynolds number, ۴۰-۹۵۰۰. In the initial stages, there is only an unstable symmetrical flow behind the cylinder and the vortex shedding is not started yet. But, in the high Reynolds number flows, two distinctive flow patterns, namely α and β are detected. The mechanism of generation of the primary and the secondary eddies can be related to the production, convection and diffusion of the vorticity field and the time dependent structure of the flow field in the wake zone behind the cylinder. The length of the computational domain, downstream of the cylinder, is selected ۲۵ times of the cylinder's diameter. Regarding such a lengthy computational domain it is possible to detect the mechanism of generation, pairing and growth of the large scale structure, eddies. Although the instantaneous numerical results are calculated, no corresponding comparable results are available. Therefore, the validity of the results in this stage is only qualitative. For the quantitative comparison of the results, after the establishment of the stationary state, time averaged based indicators such as separation angle, drag coefficient, lift coefficient, Strouhal number and ... are calculated. The numerical results accurately fall within the range of the experimental measurements.

کلمات کلیدی:

Cylinder, Wake, Turbulent Flow, Vortex, Random Walk, Lagrangian, Drag, Lift, Separation Angle

لینک ثابت مقاله در پایگاه سیویلیکا:

<https://civilica.com/doc/1415530>

