Numerical simulation of cross-flow around four cylinders by

Local Domain Free Discretization-Immersed Boundary Method

*Y.L.Wu[1], C.Shu[2], and H.Ding[3]

[1]Llord's Register Global Technology Centre, 1 Bukit Batok Street 22 #03-02, Singapore 659592.
[2]Department of Mechanical Engineering,, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260
[3]Department of Modern Mechanics, University of Science and Technology of China, Hefei, China

*Corresponding author: yanling.wu@LR.ORG

Cross-flow of fluid around a group of cylinders has practical importance in engineering applications, such as offshore oil and gas pipelines. From the viewpoint of traditional numerical method in Computational Fluid Dynamics (CFD), the mesh generation in the flow domain for this kind of problem is obviously not a trivial task. In this paper, a hybrid of Local Domain Free Discretization and Immersed Boundary Method (termed as LDFD-IBM), is applied to simulate the flow over four circular cylinders in an in-line square configuration. LDFD-IBM belongs to the family of "Cartesian mesh methods", which means the complication of mesh generation is avoided for the problems with complex geometries. A Stencil Adaptive Mesh Refinement (SAMR) is also adopted to improve the computational efficiency. Instantaneous flow patterns and other quantitative information from the numerical simulation agree well with the available data from literatures.

Keywords: Flow over cylinders, Cartesian mesh method, LDFD-IBM, Local Domain-Free Discretization, Immersed Boundary Method, Stencil Adaptive Mesh Refinement