Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Direct numerical simulation of lock-on phenomenon in the wake of a circular cylinder[1] JUNG YUL YOO, JI YONG PARK, Seoul National University, NOMA PARK, University of Minnesota — Lock-on phenomenon in the wake of a circular cylinder is investigated at the Reynolds number of 360 using direct numerical simulation. To induce lock-on, a streamwise velocity perturbation with a frequency of twice the natural shedding frequency, is superimposed on the mean velocity. The Reynolds stresses are investigated to analyze the streamwise force balance acting on the recirculation region. In the perturbed flow, the base pressure is shown to decrease mainly due to the reversal of the Reynolds shear stress. It is also shown that, with the perturbation, the strength of the primary vortices increases whereas that of the secondary vortices decreases significantly. Further, the wavelength of the secondary vortices increases by 2.5 times under the lock-on condition, which causes the three-dimensional vortical structure in the non-perturbed cylinder wake to become a two-dimensional one.

[1]Supported by Korea Institute of Science and Technology Information (KISTI) under "The Sixth Strategic Supercomputing Support Program."

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Date submitted: 02 Aug 2005 Electronic form version 1.4