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Suppressed wake transition and vortex lock-on phenomena in a perturbed flow past a circular cylinder at $Re = 220$ ¹ JUNG YUL YOO, SOO HYEON KIM, JOONG HUN BAE, Seoul National University — Direct numerical simulation (DNS) is performed to investigate the change of vortex structure and lock-on phenomena in the wake of a circular cylinder disturbed by sinusoidal perturbation at the Reynolds number of 220 (A-mode instability regime). The sinusoidal perturbation, of which the frequency is near twice the natural shedding frequency, is superimposed on the free stream velocity. The power spectra of the streamwise velocity signal and orthogonal enstrophy are investigated to analyze the change of vortex structure. It is observed that the wake transition behind the circular cylinder can be suppressed due to the sinusoidal perturbation. And this change causes the jump of the Strouhal number from the value corresponding to A-mode instability regime to the value corresponding to retarded wake transition regime (extrapolated from laminar shedding regime) in the Strouhal-Reynolds number relationship. As a result, the vortex shedding frequency is locked on the perturbation frequency depending not on the natural shedding frequency but on the modified shedding frequency.

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