원형실린더 후류에서 와류동력학적 유동공진 연구

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Dynamics of locked-on vortex in a perturbed cylinder wake

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Key Words: Lock-on(유동공진), Phases of vortex evolution(와류발달위상)

Abstract : The phenomenon of vortex lock-on is investigated by applying a time-resolved PIV technique in the wake-transition regime at the Reynolds number 360, which is observed at the near-wake behind a circular cylinder in an oscillatory flow with non-zero mean velocity. The lock-on occurs when the cylinder wake is perturbed at twice the natural shedding frequency. Then, in a mean recirculation region, we analyze the dynamic behavior of the shed vortices and the phases of vortex evolution. A dramatic change is demonstrated in the trajectory of the shed vortices, which is evaluated from a hybrid method based on complex eigenvalue and vortex centroid. A novel method to identify the phases of the vortex evolution is proposed in accordance with the distribution of the coherent Reynolds shear stress. It is shown that two flow fields in the natural shedding and lock-on states have a phase difference of about $\pi/4$.

단단 축류압축기 동익 및 정익의 Stacking Line형상 최적화

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Optimization of Stacking Line in Rotor and Stator Blades of Single-Stage Transonic Axial Compressor

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Key Words: Transonic Axial Compressor(천음속 축류압축기), Optimal Design(최적설계), Stacking Line(중첩선), Adiabatic Efficiency(단열효율)

Abstract : Optimization of stacking line in rotor and stator blades has been performed to increase an adiabatic efficiency in a single-stage transonic axial compressor. The adiabatic efficiency is selected as an object function, and the blade optimization is performed using a response surface method and three-dimensional Navier-Stokes equations. Throughout the shape optimization of rotor and stator blades, the adiabatic efficiency is increased by moving the separation line to the downstream on the blade suction surface. It is found that the increase of adiabatic efficiency by optimization of the blade shape with the stacking line in the single-stage transonic axial compressor is more effective in a rotor blade rather than a stator blade because of the large deformation of blade shape in the stator blade.