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Physics behind vortex-induced vibration reduction using an oblique trailing edge hydrofoil AMIRREZA ZOBEIRI, FRANCOIS AVELLAN, MOHAMED FARHAT, Laboratory for Hydraulic Machines, EPFL, Lausanne, Switzerland — The issue of vortex-induced vibration based on the phenomenon of vortex shedding behind a bluff body is a major problem in hydraulic machinery. Resulting fluctuating forces may lead to excessive vibrations and premature cracks. It is well known that a hydrofoil with an oblique trailing edge reduces vibration as compared to that with a blunt trailing edge. However physics behind this is not fully understood. The purpose of the present work is to conduct an experimental investigation of vortex shedding dynamics in the wake of an oblique trailing edge hydrofoil to understand the phenomena and the reasons for vibration reduction. This could help optimize the trailing edge shape and diminish the induced vibration. A velocity survey in the hydrofoil wake is performed via Laser-Doppler and Particle Image velocimetry using the Proper-Orthogonal-Decomposition technique for post-processing. In addition, flow induced vibration measurements and high speed visualization are performed. The high-speed videos clearly demonstrate alternate shedding of the vortices transforming into nearly simultaneous shedding at the hydrofoil trailing edge. As a result, partial cancellation is observed for upper and lower vortices, accompanied by the thickening of the lower vortex core that is believed to be the primary reason of the vibration reduction.

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