Optimal formation of consecutive vortex rings from a pulsed jet

Tuesday, March 11, 2014, 3:30P.M.

Lower Level Auditorium, Geddes Hall

Refreshments served at 3:00 p.m. in the Geddes Hall Coffee House

Inspired by animals such as squids and medusae, using a pulsed jet to generate consecutive vortex rings presents an energy-efficient propulsion mechanism. The performance of vortex-based propulsion is governed by vortex ring formation dynamics and a key hydrodynamic feature is that there is a limit for ring growth. Previous studies on vortex ring formation have mostly focused on isolated ring formation from a starting jet and established that the limiting process is described by a non-dimensional parameter, i.e., the formation time. However, the ring formation process in a pulsed jet is significantly different than that of a starting jet because, when rings are generated in a repeated fashion, the interaction between rings alters the dynamics of jet shear layer and vortex formation. Using a classic piston-cylinder setup, this experimental study demonstrates that the formation time alone is not sufficient to describe the ring formation process and the pulsing frequency also plays an important role. The study finds that when a pulsed jet with high pulsing frequency generates consecutive vortex rings in close proximity, the forming ring pinches off at a significantly smaller formation time compared with that in isolated ring formation. The reduced limiting formation time in consecutive ring formation from a pulsed jet is explained by a theoretical model.

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If you are interested in meeting individually with Dr. Peng, please contact Linda at 631-5431.