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Consecutive vortex ring formation from a pulsed jet

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A key hydrodynamic feature of vortex ring formation with implication to propulsion is that there is a limit in ring growth. Gharib et al. (1998) and subsequent studies have established the limiting process on isolated vortex ring formation from a starting jet, and associated optimal ring formation with the limiting formation time (stroke distance to piston diameter ratio). The ring formation process of 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. The project studies the roles of formation time and pulsing frequency in the formation and interaction of consecutively generated vortex rings for use in propulsion systems. In this experimental study, multiple vortex rings are generated consecutively from a pulsed jet. The rings form and interact with each other depending on the defined parameters. Using digital particle image velocimetry, the flow fields are quantified and analyzed. The study demonstrates that the limiting formation time is reduced significantly when a pulsed jet generates consecutive vortex rings in close proximity and the reduction is determined by the pulsing frequency. The parameters for optimal vortex formation are also studied to apply to engineering propulsion systems.

Biography

Zachary Garcia is a Graduate student completing a Master's degree in Mechanical Engineering at the University of Alaska Anchorage.

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