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Biologically inspired impulsive starting and maneuvering for solitary and aggregate systems ALEXANDRA TECHET, MIT — Fast starting and maneuvering in the aquatic realm typically involve the formation of distinct vortex rings that deliver an impulsive change in the animal's momentum. This enables these aquatic animals to maneuver in smaller spaces than that required by conventional underwater vehicles. PIV and dye visualization results from fast-starting and jumping fish, as well as impulsively starting flapping foils and propellers will be compared with unsteady propulsion by salps. Salps, or pelagic tunicates, are common gelatinous organisms in oceanic waters, which swim and maneuver by jet propulsion. Inspecting the wake generated by a rapidly maneuvering fish, foil or propeller offers insight into the impulse imparted on the system during the maneuver. Modeling the wake of maneuvering systems as a series of vortex ring impulses, with considerations taken for added mass effects, allows for relatively straightforward analysis. The swimming and maneuvering of aggregate swimmers, e.g. those chained together in series or parallel, can be modeled using a series of distinct vortex rings generated by each individual in the chain, with some phase shift between each individual.

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