Modeling multiple pacemaker control in jellyfish locomotion

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Recent studies have found that there are important neuromechanical constraints that arise from the timescales associated with neuromuscular activation and the elastic response of flexible appendages or bodies. In jellyfish, the neuromuscular response is governed by the interaction of pacemakers with the underlying motor nerve net that communicates with the musculature. This set of equally-spaced pacemakers, located at the bell rim, alter their firing frequency in response to environmental cues, allowing for different swimming modes to be activated when sets of pacemakers fire in concert. In this work, we explore the control of neuromuscular activation with a 3D computational FSI model of a jellyfish bell immersed in a viscous fluid and use numerical simulations to describe the interplay of multiple pacemakers. We will look at the role a single pacemaker can play, as well as when a pair of pacemakers fire in unison and the resulting fluid dynamics that can result from their interaction. We will then comment on the pacemaker firing frequency implications on control and stability.