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Synchronization modes of active microfilaments YI MAN, EVA KANSO, University of Southern California — Biological filaments are rarely found in isolation. Eukaryotic flagella beat in synchrony, an array of cilia generate the phase-locking metachronal wave. Experimental and computational studies provide a body of evidence that active filaments can synchronize through hydrodynamic coupling only. Previous theoretical models mostly address interactions in a far-field regime, where the interfilamentous distance h is much larger than the filament length L. Here, we employ a simple active filament model and combine it with an asymptotic result of hydrodynamic interactions in a more biologically-relevant regime where $h/L \ll 1$. By varying the activity and coupling strength, we find three synchronization modes: in-phase, anti-phase, and a new mode which we refer to as *asymmetric synchronization*. We map the basins of attraction of these modes and find bistable in-phase and anti-phase synchronization when the coupling is strong. Furthermore, we present a thorough Floquet-type stability analysis to show the evolution of the phase difference between two filaments. The Floquet analysis proves the existence of the new mode of *asymmetric synchronization*, and it reveals a time scale it takes to reach the synchronized equilibria.

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