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A dynamical system for interacting flapping swimmers[1] ANAND OZA, SOPHIE RAMANANARIVO, LEIF RISTROPH, MICHAEL SHELLEY, New York University, Courant Institute — We present the results of a theoretical investigation into the dynamics of interacting flapping swimmers. Our study is motivated by the recent experiments of Becker et al.,[2] who studied a one-dimensional array of self-propelled flapping wings that swim within each other's wakes in a water tank. They discovered that the system adopts certain "schooling modes" characterized by specific spatial phase relationships between swimmers. To rationalize these phenomena, we develop a discrete dynamical system in which the swimmers are modeled as heaving airfoils that shed point vortices during each flapping cycle. We then apply our model to recent experiments in the Applied Math Lab, in which two tandem flapping airfoils are free to choose both their speed and relative positions. We expect that our model may be used to understand how schooling behavior is influenced by hydrodynamics in more general contexts.

[1]Thanks to the NSF for its support.
[2]Becker, A., Masoud, H., Newbolt, J., Shelley, M. & Ristroph, L. "Hydrodynamic schooling of flapping swimmers" (submitted).

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