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The constrained dipole dynamical system ANDREW TCHIEU, EVA KANSO, PAUL NEWTON, University of Southern California — In this presentation the notion of a *constrained dipole* is introduced as a pair of equal and opposite strength point vortices (i.e. a vortex dipole) separated by a finite distance such that this distance remains constant throughout the time evolution of the vortex dipole. The current formulation unambiguously defines a self-propelling velocity for the dipole. Equations of motion for N constrained dipoles interacting in an unbounded inviscid fluid are derived from the modified interaction of $2N$ independent vortices subject to the constraint that the inter-vortex spacing of each constrained dipole remains constant. There are no far-field assumptions for the dipole-dipole interactions. We discuss the dynamics of the system of equations in the context of uncoordinated self-propelled motion in a perfect fluid and give examples of interactions of two, three, and many constrained dipoles. Dipoles are found to collide with one another in abreast formations. Alternatively, the dipoles are conducive to remaining in formation when placed in staggered and diamond formations. Interestingly, equilibria are also formed from these aforementioned interactions, and we investigate the polygonal configurations of constrained dipoles and their subsequent stability. It is found that the $N = 3$ case is linear stable, whereas $N > 3$ is linearly unstable.

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