

# A Self-Propelled Particle Model of Schooling

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## Abstract

The cohesive movement of a biological population is a commonly observed phenomenon. Particularly striking examples include schooling fishes and flocking birds. Often, individuals in a swarm can only communicate locally (i.e., with nearest neighbours), yet the aggregate remains cohesive. The mechanism through which individuals maintain global patterns is not well-understood, but is generally attributed to 'social forces' between neighbours, including attraction, repulsion, and alignment forces. In addition to this biological motivation, recent interest has grown to include the programming of groups of unmanned vehicles.

A Lagrangian model of interacting self-propelled particles is used to investigate properties of school formations. The system admits a number of interesting solutions, including 'soldier formations' and 'mill formations', both of which allow analytical insight due to their geometric regularity. In this talk I will introduce the model and biological motivation, discuss some existence and stability results of particular solutions, and show some numerical simulations.