Repulsive-attractive Models in Collective Behavior and Applications

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Abstract: I will present a survey of the main results about first and second order models of swarming where repulsion and attraction are modelled through pairwise potentials. We will mainly focus on the stability of the fascinating patterns that you get by random data particle simulations, flocks and mills, and their qualitative behavior. The relation to aggregation equations will be exploited. Some aspects of the qualitative properties of these shapes will be based on a deep analysis of the minimization of interaction energies. We will discuss properties of solutions to aggregation-diffusion equations appearing in many biological models such as cell adhesion, organogenesis and pattern formation. We will concentrate on typical behaviours encountered in systems of these equations assuming different interactions between species under a global volume constraint.

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