Emergence of Well-Ordering and Clustering for a First-Order Nonlinear Consensus Model

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Abstract

We study the predictability of asymptotic clustering patterns in a first-order nonlinear consensus model on a receiver network on the real line. Nonlinear couplings between particles (agents) are characterized by an odd, locally Lipschitz and increasing function. The proposed consensus model and its clustering dynamics are motivated by the one-dimensional Cucker–Smale flocking model. Despite the complexity registered by heterogeneous couplings, we provide a sufficient framework to predict asymptotic dynamics such as particles' aggregation, segregation, and clustering patterns. We also verify the robustness of clustering patterns to structural changes such as relativistic effects implemented by the suitable composition of functions.