Spectral Analysis of Bochner-Positive Alignment Models and Application to Relaxation

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Abstract

We will identify a class of alignment models where the spectral gap condition – necessary for the analysis of long time behavior – can be associated with the positive-definiteness of the averaging protocol. We show that if the communication kernel factors through a feature space with organized underlying structure, such as a connected abelian group, then the spectral gap can be computed in terms of thickness of the flock. This leads to vast generalizations of the previously established relaxation results for kinetic Fokker-Planck-alignment models as well as regularity of solutions.