

Existence and Weak-Strong Uniqueness of Measure Solutions to Euler-Alignment/Aw-Rascle-Zhang Models

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Abstract

We study the multi-dimensional Euler-alignment system with a matrix-valued communication kernel, motivated by models of anticipation dynamics in collective behaviour. A key feature of this system is its formal equivalence to a nonlocal variant of the Aw-Rascle-Zhang (ARZ) traffic model, in which the desired velocity is modified by a nonlocal gradient interaction. We prove the global-in-time existence of measure solutions to both formulations, obtained via a single degenerate pressureless Navier-Stokes approximation. Furthermore, we establish a weak-strong uniqueness principle adapted to the pressureless setting and to nonlocal alignment forces. As a consequence, we rigorously justify the formal correspondence between the nonlocal ARZ and Euler-alignment models: they arise from the same inviscid limit, and the weak-strong uniqueness property ensures that, whenever a classical solution exists, both formulations coincide with it.