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Title : On a hyperbolic-elliptic system having discontinuous self-similar solutions

Collective motion of self-propelling particles is ubiquitous in many environmental systems. Mathematical models that can be solved analytically are useful for comprehension of the collective motion. Firstly, we present a mathematical framework to determine a system of partial differential equations describing simplified collective motion from a discontinuous self-similar population profile. The resulting system is a hyperbolic-elliptic system. We present numerical schemes based on monotone and essentially-oscillatory finite volume methods for discretization of the system. Convergence rate of the numerical schemes are assessed through their applications to analytical solutions.