Susanne Solem

A second-order numerical method for the aggregation equation

We propose a second-order numerical method for the aggregation equation with pointy attractive interaction potentials, for which simulations can be continued after the first occurrence of Dirac measures in the solution. The method is motivated by the equivalence between a Burgers-type equation and the one-dimensional aggregation equation with potential plus/minus —x—, see [1]. The starting point is a second-order accurate finite volume method for solutions the Burgerséquation which is ẗranslatedïnto a scheme for the aggregation equation. When the potential is pointy attractive, the numerical approximation converges towards the unique gradient flow solution in the 1–Wasserstein metric. Furthermore, numerical experiments verify the expected second-order convergence rate in the 1–Wasserstein distance for sufficiently smooth data, and show that the method also works well for potentials that are not necessarily pointy attractive.

This is joint work with Jos A. Carrillo and Ulrik S. Fjordholm.

[1] G.A. Bonaschi, J.A. Carrillo, M. Di Francesco and M.A. Peletier. Equivalence of gradient flows and entropy solutions for singular nonlocal interaction equations in 1D. ESAIM: COCV, 21:414–441, 2015.