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Height-constrained nonlocal interactions energies via degenerate diffusion

Height-constrained nonlocal interaction energies have recently appeared in models of collective behaviour such as biological swarming and pedestrian crowd motion. The minimization of these energies can also be seen as a "liquid-solid" phase transition where a mixture of two states is possible. Here the additional hard height constraint on admissible functions poses significant challenges both analytically and numerically, and, in order to overcome these challenges, we consider a regularization of the energies by including a highly degenerate diffusion term and approximate the height-constrained model by the unconstrained ones. Justifying our approach analytically in the context of Γ-convergence we implement this scheme numerically in two dimension, and compute steady states via particle approximations. This is a joint project with Katy Craig.