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Recent Works on Variational Problems

For work 1, the functional of the variational problem consists of two terms: the perimeter of the input subset and an interaction integral with a kernel that is the sum of a logarithmic function and a quadratic function. This kernel is bounded below and tends to infinity at zero and infinity. A single disk is always a critical point of the functional, but its stability depends on the parameters of the problem. When the parameters are in a suitable range there exist assemblies of multiple perturbed disks that are stable critical points. For work 2, the functional of the variational problem combines an interface short-range interaction energy promoting micro-domain growth with a Coulomb-type long-range interaction energy which prevents micro-domains from unlimited spreading. Here we consider a scenario in which two species are dominant, and one species is vanishingly small. In this scenario two energy levels are distinguished: the zeroth-order energy encodes information on the optimal arrangement of the dominant constituents, while the first-order energy gives the shape of the vanishing constituent. This first-order energy also shows that, for any optimal configuration, the vanishing phase must lie on the boundary between the two dominant constituents and form lens clusters.