

We have investigated gradient models, one of them was a model with double-well potential and the other one a so called extended model. In dimension two we have calculated exact free energies of the disseminated edge configurations for the extended model and for arbitrary dimension we have derived bounds on these free energies. Combining these bounds with an argument on existence of bad contours together with the estimate of the number of these contours and using the method of reflection positivity we have been able to show that at low temperatures there is a phase transition in the extended model. We have further shown that the phase transition exists also in the double-well model as long as a conjecture on estimates of mean energy holds.

Besides these results the thesis also contains basic tools of statistical physics and facts from related fields, as well as basic results on gradient models, so that our work can serve as an introduction into these areas.