



The book is concerned with the analysis of singularities that appear in several variational problems. These singularities play the role of vortex lines for superconductors, vortices in Bose-Einstein condensates or domain walls in micromagnetics. Their study requires a good understanding of maps with values into the unit circle. The first part of the book treats the question of lifting of maps of bounded variation with values into the unit circle, together with the analysis of their topological singularities. In the second part, we study the vortex structure of a rotating Bose-Einstein condensate. The critical rotational velocities are estimated for having exactly n vortices inside the bulk of the condensate; their topological charge and their precise location are also determined. Next we are interested in one-dimensional transition layers which connect two opposite magnetizations (so called Neel walls) in thin-film micromagnetics. The compactness and the optimality of the Neel wall under two-dimensional perturbations are proved. This book covers original results of the author written during his PhD thesis.



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