

Ginzburg-Landau Vortices



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GINZBURG-LANDAU VORTICES



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Book Condition: New. Publisher/Verlag: Springer, Basel | The original motivation of this study comes from the following questions that were mentioned to one of us by H. Matano. Let $\Omega \subset \mathbb{R}^2$ be a bounded domain with boundary $\partial\Omega$. Consider the Ginzburg-Landau functional $E_\varepsilon(u) = \int_\Omega |\nabla u|^2 + \frac{1}{2\varepsilon^2} (|u|^2 - 1)^2$ which is defined for maps $u \in H^1(\Omega; \mathbb{C})$ also identified with $H^1(\Omega; \mathbb{R}^2)$. Fix the boundary condition $u|_{\partial\Omega} = \gamma$ on $\partial\Omega$ and set $H_\varepsilon = \{u \in H^1(\Omega; \mathbb{C}) : u|_{\partial\Omega} = \gamma\}$. It is easy to see that (2) is achieved by some u_ε that is smooth and satisfies the Euler equation in Ω , $-\Delta u_\varepsilon = \frac{1}{\varepsilon^2} u_\varepsilon (|u_\varepsilon|^2 - 1)$ (3) { on Ω } The maximum principle easily implies (see e.g., F. Bethuel, H. Brezis and F. Helein [2]) that any solution u_ε of (3) satisfies $|u_\varepsilon| \sim 1$ in Ω . In particular, a subsequence (u_{ε_j}) converges in the $W^{1,2}(\Omega)$ topology to a limit u . | I. Energy estimates for S^1 -valued maps.- 1. An auxiliary linear problem.- 2. Variants of Theorem I.1.- 3. S^1 -valued harmonic maps with prescribed isolated singularities. The canonical harmonic map.- 4. Shrinking holes. Renormalized energy.- II. A lower bound for the energy of S^1 -valued maps on perforated domains.- III. Some basic estimates for u_ε .- 1. Estimates when $\Omega = \mathbb{R}^2$ and $g(x) = x/|x|$.- 2. An upper bound for $E_\varepsilon(u_\varepsilon)$.- 3. An upper bound for $\frac{1}{\varepsilon^2} \int_\Omega (|u_\varepsilon|^2 - 1)^2$.- 4. $\frac{1}{\varepsilon^2} \int_\Omega (|u_\varepsilon|^2 - 1)^2 \geq \frac{1}{\varepsilon^2} \int_\Omega (|u_\varepsilon|^2 - 1)^2$ on "good discs".- IV. Towards locating the singularities: bad discs and good discs.- 1. A covering argument.- 2. Modifying the bad discs.- V. An upper bound for the energy of u_ε away from the singularities.- 1. A lower bound for the energy of u_ε near a_j .- 2. Proof of Theorem V.1.- VI. u_ε converges: u_ε is born!.- 1. Proof of...



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