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Compactness of the Néel wall

Radu Ignat
ignat@ann.jussieu.fr
Laboratoire Jacques-Louis Lions
Université Pierre & Marie Curie
B.C. 187
4 Place Jussieu
75252 Paris Cedex 05
France

Felix Otto
otto@iam.uni-bonn.de
Institute of Applied Mathematics
University of Bonn
Wegelerstrasse 10
53115 Bonn
Germany

Abstract

We study the asymptotics of a family of energy-functionals coming through dimensional reduction of a three dimensional model in a thin film. We prove compactness for families of magnetizations in the energy regime corresponding to a finite number of Néel walls. The accumulation points are unit-valued divergence-free vector fields. In the case of zero-energy states, we show locally Lipschitz continuity and these limits classically satisfy the principle of characteristics. Then we are interested in transition layers which connect two opposite magnetizations in a strip. We prove the optimality of the straight walls under $2d$ variations in the regime of the specific line energy of the Néel wall. In the general regime of a finite number of Néel walls, we show that $1d$ magnetizations do concentrate on vertical lines in the strip.