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Euler-Lagrange Inclusions and Existence of Minimizers for a Class of Non-Coercive Variational Problems

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Abstract: We are concerned with integral functionals of the form
J(v)\doteq \int_{B_R^n} \left[f(|x|,|\nabla v(x)|)+h(|x|,v(x))\right] dx,
defined on $W^{1,1}_0(B_R^n, \mathbb{R}^m)$, where B_R^n is the ball of $\mathbb{R}^n$ centered at the origin and with radius $R>0$. We assume that the functional J is convex, but the compactness of the sublevels of J is not required. We prove that, under suitable assumptions on f and h, there exists a radially symmetric minimizer $v\in W^{1,1}_0(B_R, \mathbb{R}^m)$ for J. Moreover, we associate to the functional J a system of differential inclusions of the Euler-Lagrange type, and we prove that the solvability of these inclusions is a necessary and sufficient condition for the existence of a radially symmetric minimizer for J.

Keywords: Calculus of variations, existence, Euler-Lagrange inclusions, radially symmetric solutions, non-coercive problems

Classification (MSC2000): 49J10, 49K05; 49J30

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