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Lavrentieff Phenomenon and Non Standard Growth Conditions

The functional $F(u) = \int_B f(x, Du)\, dx$ is considered, where B is the unit ball in $\mathbb{R}^n$, u varies in the set of the locally Lipschitz functions on $\mathbb{R}^n$, and f belongs to a family of integrands containing, as model case, the following one

$$f : (x, z) \in \mathbb{R}^n \times \mathbb{R}^n \mapsto \frac{|<z, x>|}{|x|^n} + |z|^p, \quad 1 < p < n.$$

The computation of the relaxed functional of F is provided. The formula obtained shows the persistence of the Lavrentieff Phenomenon. Examples of integrands not exhibiting the Lavrentieff Phenomenon are also presented, showing that this phenomenon is not linked only to the non standard growth behaviour of integrands.

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