Critical points with prescribed energy for a class of functionals depending on a parameter.

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Abstract.

Given $c \in \mathbb{R}$ we look for couples $(\lambda, \mu) \in \mathbb{R} \times X$ solving the problem

$$\phi'_{\lambda}(u) = 0, \ \phi_{\lambda}(u) = c$$

Here $\phi_{\lambda} = I_1 - \lambda I_2$, where $I_1$ and $I_2$ are $C^1$ even functionals on a Banach space $X$. Under further conditions on $I_1$ and $I_2$ we prove the existence of infinitely many couples $(\lambda_{n,c}, u_{n,c})$ solving this problem. More generally, we analyze the structure of the solution set of this problem with respect to $\lambda$ and $c$. In particular, we show that the maps $c \mapsto \lambda_{n,c}$ are continuous, which gives rise to a family of energy curves for this problem. The analysis of these curves provide us with several bifurcation type results, which are then applied to some elliptic problems. Our approach is based on the nonlinear generalized Rayleigh quotient method.

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