A variational principle for problems in partial differential equations and Analysis

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In a wide range of mathematical problems the existence of a solution is equivalent to the existence of a fixed point for a suitable map or a critical point for an appropriate variational or hemi-variational problem. In particular, in real life applications we are interested in finding such solutions which possesses certain properties. The existence theory is therefore of paramount importance in several areas of mathematics and other sciences. In this paper we shall provide a variational principle that allows us to solve problems of the general form $0 \in \mathcal{F}(u)$, for a possibly multi-valued map $\mathcal{F}$ on a given convex set K. This variational principle has many applications in partial differential equations while unifies and generalizes several results in nonlinear Analysis such as the fixed point theory, critical point theory on convex sets and the principle of symmetric criticality.

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