Nonsmooth variational methods with applications to nonlinear problems in Mechanics

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A nonsmooth critical point theory is constructed for functionals which are expressed as a sum $\Phi + \Psi$ with Φ locally Lipschitz and Ψ convex, lower semicontinuous, proper. This approach unifies various boundary value problems with discontinuities and variational inequalities. The critical points correspond to the weak solutions. In addition to the existence of (nontrivial) solutions, the multiplicity and the location are studied. The abstract nonsmooth variational results are applied to variational-hemivariational inequalities in the sense of P. D. Panagiotopoulos. The relationship with nonlinear mathematical programming problems with constraints described in terms of closed range operators is discussed. One considers an application to an adhesive contact problem formulated through variational-hemivariational inequalities. Finally, using nonsmooth variational methods, some nonlinear eigenvalues problems arising in Unilateral Mechanics are investigated.