Nonsmooth Problems with Applications in Mechanics
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Periodic Hamiltonian Systems and Applications in Shape/Topology Optimization

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Abstract: We consider shape/topology optimization problems governed by linear elliptic equations with Neumann boundary conditions, in dimension two. A similar treatment is possible for other boundary conditions or elliptic operators. The unknown domains, where the boundary value problem is defined, are assumed to be contained in a given holdall bounded domain. They are represented via level set functions (from a given family) and their boundary is described analytically by Hamiltonian systems (ordinary differential equations) associated to the level set function. The domains may be multiply connected and during the algorithm their topology characteristics may change. Such changes may have a nonsmooth character. An essential argument in the setting of this new approach, obtained via the Poincaré-Bendixson theory, is the periodicity property of the Hamiltonian systems and the differentiability of their period with respect to functional variations. The applications concern optimality conditions and numerical approaches.