



Contents

1	Introduction	9
2	Theoretical Background	13
2.1	Some Elements of Nonsmooth Analysis	13
2.2	Some Inequalities and Preliminary Results in Function Spaces	16
2.3	Pseudomonotone Operators	19
3	Existence Result and Approximation	21
4	Uniqueness Result	27
5	Hemivariational Inequalities	29
5.1	Modeling	29
5.2	A General Definition of the HVI Problem and Some Remarks	33
6	Smoothing Approximation via Convolution	37
6.1	The Case of Bounded Support of the Density	39
6.2	The Case of Infinite Support of the Density	41
7	Smoothing Approximation for Maximum Function	43
8	Some Examples of Smoothing Functions	55
8.1	NN Density Function	55
8.2	Zang Density Function	60
8.3	HPZ Density Function	64
9	Coercive HVI on the Boundary	71
9.1	Statement of the Problem	71



9.2	Uniqueness Result	74
10	Approximation of HVI with Maximum Superpotential	79
10.1	Formulation of the Problem	79
10.2	Regularization Method	82
10.3	Convergence of the Regularization Method	93
10.4	Some A-posteriori Error Estimates	102
10.5	Piecewise Linear Finite Element Approximation	103
10.5.1	Preliminary Results	109
10.5.2	Verification of the Hypotheses	115
10.6	Some Error Estimates	120
10.6.1	A Céa-Falk Lemma for HVI	121
10.6.2	Error Estimates for Conforming FEM	122
10.7	Piecewise Quadratic Finite Element Approximation	129
10.8	The Case $f : \Gamma \times \mathbb{R}^m \rightarrow \mathbb{R}$	132
11	Semicoercive HVI	135
12	Approximation of HVI on the Domain	139
12.1	Piecewise Linear Finite Element Approximation	139
12.2	Piecewise Quadratic Finite Element Approximation	146
12.3	The Case $f : \Omega \times \mathbb{R}^m \rightarrow \mathbb{R}$	148
12.4	The Case of Nonquadratic Growth of Energy	149
13	Applications in Mechanics	155
13.1	A Friction problem in Plane Linear Elasticity	155
13.2	An Adhesive Contact Problem	158
13.3	A Nonmonotone Skin Friction Problem in Plane Elasticity	159
14	Numerical Examples	161
14.1	Bilateral Contact with Nonmonotone Friction	162
14.2	A Delamination Problem	170
14.3	Nonmonotone Unilateral Contact Without Friction	180