

## Contents

<b>Resumen</b>	<b>3</b>
<b>Abstract</b>	<b>4</b>
<b>1. Introduction and objectives</b>	<b>7</b>
<b>2. Discontinuous Galerkin methods for elasticity</b>	<b>9</b>
2.1. Domain discretization . . . . .	9
2.2. Governing form . . . . .	10
2.3. Weak form of the problem . . . . .	10
2.4. Consistency of the discontinuous Galerkin methods . . . . .	14
2.5. Stability of the discontinuous Galerkin methods . . . . .	15
<b>3. Interior penalty method for elasticity</b>	<b>17</b>
3.1. Weak form of interior penalty method . . . . .	17
3.2. Consistency and conservation properties of interior penalty method . . . . .	18
3.3. Symmetry of the bilinear form . . . . .	19
3.4. Stability . . . . .	19
3.5. Discretization of the weak form . . . . .	20
3.6. Computer implementation . . . . .	24
3.7. Elasticity examples . . . . .	27
3.7.1. Error analysis theory . . . . .	27
3.7.2. One dimensional example . . . . .	28
3.7.3. Two dimensional example . . . . .	34
<b>4. Discontinuous Galerkin methods for elastoplasticity</b>	<b>39</b>
4.1. Non-symmetric discontinuous Galerkin method . . . . .	39
4.1.1. Weak form of non-symmetrical discontinuous Galerkin method . . . . .	39
4.1.2. Spatial discretization of non-symmetric discontinuous Galerkin method	40
4.1.3. Linearization of non-symmetric discontinuous Galerkin method . . . . .	40
4.2. Interior penalty method . . . . .	45
4.2.1. Weak form of interior penalty Method . . . . .	45
4.2.2. Spatial discretization of interior penalty method . . . . .	47
4.2.3. Linearization of interior penalty method . . . . .	47
4.3. Plasticity examples . . . . .	50
4.3.1. One dimensional example . . . . .	50
4.3.2. Two dimensional example . . . . .	57

*Contents*

<b>5. Conclusions</b>	<b>61</b>
<b>A. Average and jump operators</b>	<b>63</b>
<b>B. Discretization</b>	<b>65</b>
<b>C. Plasticity</b>	<b>67</b>
C.1. Stress-strain relationship . . . . .	67
C.2. Yield criterion . . . . .	70
C.2.1. One dimension yield criterion . . . . .	72
C.2.2. The von Mises yield criterion . . . . .	72
<b>D. Computational plasticity</b>	<b>75</b>
D.1. One dimension case . . . . .	75
D.2. Two dimension plane strain case using von Mises yield criterion . . . . .	77
D.2.1. Consistent tangent modulus . . . . .	80
<b>References</b>	<b>84</b>