

# Contents

<b>Introduction</b>	<b>1</b>
<b>1 Objectives</b>	<b>5</b>
1.1 General Objective . . . . .	5
1.2 Specific Objectives . . . . .	5
<b>2 Methodology</b>	<b>6</b>
<b>3 Theoretical Background</b>	<b>8</b>
3.1 Architectural and Operational Aspects . . . . .	8
3.2 Materials . . . . .	10
3.3 Solid Thermodynamics . . . . .	12
3.4 Boundary Value Problem . . . . .	13
<b>4 IGA code and validation</b>	<b>17</b>
4.1 Computational geometry . . . . .	17
4.2 NURBS . . . . .	19
4.3 NURBS geometry . . . . .	20
4.4 NURBS analysis . . . . .	23
4.5 Computer code for IGA analysis . . . . .	24
4.5.1 A class for B-splines . . . . .	25
4.5.2 A class for NURBS . . . . .	25
4.5.3 Classes for NURBS geometries . . . . .	27
<b>5 Discretization</b>	<b>29</b>
5.1 Representations of functions . . . . .	29
5.2 Discretized balance equations . . . . .	30
5.3 Classical Elasticity: a particular case . . . . .	33
<b>6 Implementation</b>	<b>38</b>
6.1 Problem with $c = 0$ . . . . .	38
6.2 The full problem . . . . .	41
<b>7 Results</b>	<b>47</b>
7.1 Problem with $c = 0$ . . . . .	47
7.2 Results for the full problem . . . . .	50
7.2.1 Circular cavity . . . . .	50

7.2.2	Thin elliptical cavity . . . . .	51
<b>8</b>	<b>Analysis</b>	<b>73</b>
8.1	Electrode particle with circular cavity . . . . .	73
8.2	Electrode particle with thin elliptical cavity . . . . .	75
8.3	Sources of error . . . . .	76
8.3.1	IGA . . . . .	76
8.3.2	Thermodynamic model . . . . .	77
<b>9</b>	<b>Conclusions</b>	<b>78</b>
	<b>Bibliography</b>	<b>80</b>