# Table of Contents

Acknowledgements  
Abstract  
Resumen  
Resum  
List of Publications  
Table of Contents  
List of figures  
List of tables  
List of abbreviations and nomenclature

## Chapter 1  Introduction

1.1. Research Background  
1.2. Scope of the work  
1.1. Aims and Objectives  
1.2. Research novelty  
1.3. Thesis structure

## Chapter 2  3D Printing

2.1. Introduction  
2.2. History and purposes of use  
2.3. Design possibilities  
2.4. Overview of current technologies  
2.5. Rise of desktop 3d printing

## Chapter 3  Fused Filament Fabrication

3.1. Introduction  
3.2. FFF 3D printers components  
3.3. FFF Process  
3.4. Summary

## Chapter 4  Design for Additive Manufacturing

4.1. Introduction  
4.2. Use of AM potentials  
4.3. Design rules  
4.4. Combined methods
Chapter 5  Design Features determination

5.1. Introduction
5.2. Prior work
5.3. Features identification
5.4. Features identification
5.5. Overhangs, bridges and angles GBTAs study
5.6. Benchmarking geometries proposal
5.7. Results
5.8. Summary

Chapter 6  Mechanical properties

6.1. Introduction
6.2. Effect of infill parameters on tensile behaviour
   6.2.1. Introduction
   6.2.2. Literature review
   6.2.3. Materials and methods
   6.2.4. Results and discussion
   6.2.5. Conclusions
6.3. Study: Determination of infill density and pattern influence in the bending behaviour
   6.3.1. Materials and methods
   6.3.2. Results and discussion
   6.3.3. Conclusions
6.4. Mechanical properties studies. Conclusions
6.5. Summary

Chapter 7  Post-processing of FFF parts

7.1. Introduction
7.2. Support removal
7.3. Surface modification
   7.3.1. Heat
   7.3.2. Chemical solutions
   7.3.3. Mechanical
   7.3.4. Surface modification. Summary
Chapter 7  Coating  Assembly  Summary

Chapter 8  Perception of components due to surface quality
8.1. Abstract  183
8.2. Introduction  184
8.3. Materials and methods  187
8.4. Results  190
8.5. Conclusions  192

Chapter 9  Case study. Thumb orthosis
9.1. Abstract  195
9.2. Introduction  196
  9.2.1. Anatomical data acquisition  198
  9.2.2. Additive Manufacturing of orthoses  199
  9.2.3. Post-treatment of FFF parts  201
  9.2.4. Open lattice structures in orthoses design  201
9.3. Aims and objectives  202
9.4. Method  202
  9.4.1. 3D Scan data acquisition  203
  9.4.2. CAD process  204
  9.4.3. 3D Printing  207
  9.4.4. Support removing  207
  9.4.5. Surface treatment  208
  9.4.6. Fastening  210
9.5. Cost analysis  210
9.6. Results and discussion  213
9.7. Conclusions and further research  215

Chapter 10 Development of a DfAM toolkit
10.1. Introduction  217
10.2. Toolkit structure  220
10.3. Identify requirements  221
10.4. Concept design. Ideation cards  222
10.5. Extract design solutions  226
10.6. Embodiment Design
   10.6.1. Main design considerations
   10.6.2. Design features
   10.6.3. Assembly considerations.
10.7. Prototype
10.8. Deliver
10.9. Summary

Chapter 11 Evaluation of the toolkit & case studies
   11.1. Introduction
   11.2. Methodology. Design of the trial
   11.3. Results & discussion
      11.3.1. Case study. Telescopic phone holder
      11.3.2. Survey
   11.4. Conclusions & future work

Chapter 12 Discussion and Conclusions
   12.1. Introduction
   12.2. Achievement of research objectives
   12.3. Contribution to knowledge
   12.4. Limitations of the research
   12.5. Future work

Bibliography

Appendix 1. Design guide
Appendix 2. Ideation cards
Appendix 3. Worksheet