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DEVELOPMENT OF DIGITAL INSTRUMENTATION FOR BOND RUPTURE DETECTION

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ABSTRACT

In the medical world the precise identification of a disease can take longer than it is safe to wait to start treatment so there is a need for faster and more precise biosensors. Bond Rupture is a new sensor technique that maybe able to improve disease detection. It does this by inducing bonds to rupture from the surface, and also measuring the point at which this rupture occurs this enables the forces to be measured on the surface. Specifically, this project has focused on the application of Bond Rupture to detecting antigens when bound to a surface using their specific antibodies, and the idea that the rupture force of these antigens can also be measured. The sensor that this project is based around is the Quartz Crystal Microbalance (QCM), which oscillates horizontally when a voltage is applied, and can also be used to measure mass change on its surface via change in resonant frequency.

The aim of this project was to investigate possible Bond Rupture detection methods and techniques and has involved the development of a high speed digital electronics system, for the purposes of inducing and detecting Bond Rupture. This has involved the development of a FPGA based high speed transceiver board which is controlled by a Digital Signal Processor (DSP), as well as the development of various graphical user interfaces for end user interaction. Bond rupture testing was carried out by rupturing beads from the surface of a QCM in an experiment taking as little as 20 seconds.

The Bond Rupture effect has been observed via the high accuracy measurement of the frequency change while inducing Bond Rupture on the sensor, proving that the Bond Rupture effect indeed exists. The research performed is believed to be a world first in terms of the method used and accuracy acquired.
Like many others before me, the thesis writing has taken much longer than originally expected. I am grateful for the patience of those around me, waiting for me to finish.

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CONTENTS

Abstract.................................................................................................................................. i
Acknowledgements .............................................................................................................. iii
Related Publications ............................................................................................................. v
Contents .................................................................................................................................. vii

1 Introduction....................................................................................................................... 1
  1.1 Background .................................................................................................................. 1
  1.2 Aims and Objectives .................................................................................................... 1
  1.3 Outline .......................................................................................................................... 2
  1.4 Major Contributions ..................................................................................................... 2

2 Literature Review.............................................................................................................. 3
  2.1 Introduction .................................................................................................................. 3
  2.2 Immunological Biosensors .......................................................................................... 3
     2.2.1 Types of Biosensors ............................................................................................... 4
     2.2.2 Immunology Basics .............................................................................................. 11
  2.3 Quartz Crystal Microbalance (QCM) .......................................................................... 15
     2.3.1 Background ............................................................................................................ 15
     2.3.2 Modelling ............................................................................................................... 16
  2.4 Measurement Types ..................................................................................................... 19
     2.4.2 Measurement Limitations ...................................................................................... 26
  2.5 Bond Rupture ............................................................................................................... 29
     2.5.1 Background ............................................................................................................ 29
     2.5.2 Characterisation .................................................................................................... 30
     2.5.3 Electronic Equipment ........................................................................................... 38
     2.5.4 Experiments and Results ...................................................................................... 41
  2.6 Analysis of Literature .................................................................................................. 43

3 Characterisation of QCM ............................................................................................... 45
  3.1 Introduction .................................................................................................................. 45
  3.2 QCM Frequency Measurement ................................................................................. 45
3.2.1 Experiment Setup ................................................................. 46
3.2.2 Software - Matlab Interface .................................................. 47
3.2.3 Frequency Stability ............................................................... 49
3.2.4 Impedance Analysis .............................................................. 51
3.3 Temperature Stability Measurement .......................................... 54
3.4 Initial Bond Rupture Experiments ............................................. 58
3.5 Implementing Bond Rupture ...................................................... 60
3.6 Design Specifications ............................................................... 61

4 Digital Transceiver System .......................................................... 63
4.1 Introduction .............................................................................. 63
4.2 Hardware .................................................................................. 65
   4.2.1 Digital Signal Processor (DSP) .................................................. 66
   4.2.2 Digital Transceiver ................................................................. 70
   4.2.3 Amplifiers ............................................................................. 75
   4.2.4 Driving Board ........................................................................ 78
   4.2.5 Hardware Integration ............................................................ 79
4.3 Software .................................................................................... 80
   4.3.1 Wobble Centre ...................................................................... 82
   4.3.2 Bond Rupture Experiment using Magnitude ......................... 86
   4.3.3 Bond Rupture Experiment using Zero Crossings .................. 92
   4.3.4 Magnitude and Frequency Calibration ................................. 100
4.4 Results and Discussion ............................................................. 103
4.5 Equipment Limitations and Proposed Improvements ................ 112
4.6 Chapter Conclusion ................................................................. 114

5 Reprogrammable Digital Transceiver System ................................ 115
5.1 Introduction .............................................................................. 115
5.2 Hardware .................................................................................. 118
   5.2.1 Introduction ......................................................................... 118
   5.2.2 Transceiver PCB ................................................................. 119
   5.2.3 DSP .................................................................................... 137
   5.2.4 Amplifiers ........................................................................... 137
   5.2.5 QCM Board ....................................................................... 143
5.3 Hardware/ Software - FPGA ..................................................... 146
5.3.1 Introduction - Transceiver System Overview .......................................................... 146
5.3.2 Address Mapping ................................................................................................. 149
5.3.3 Transmit Design .................................................................................................. 153
5.3.4 Receiver Design .................................................................................................. 157
5.3.5 Triggering ............................................................................................................ 177
5.4 Software .................................................................................................................. 179
5.4.1 Introduction ......................................................................................................... 179
5.4.2 System Code Directory Structure ................................................................. 180
5.4.3 Calibrate ............................................................................................................... 180
5.4.4 FFT Capture ......................................................................................................... 186
5.4.5 Frequency Scanner ............................................................................................. 189
5.4.6 Bond Rupture ....................................................................................................... 192
5.4.7 Conclusion ........................................................................................................... 210
5.5 Results and Discussion ......................................................................................... 210
5.5.1 Introduction ......................................................................................................... 210
5.5.2 Transceiver - Receiver ..................................................................................... 211
5.5.3 Transceiver - Transmitter ................................................................................ 215
5.5.4 Frequency Accuracy .......................................................................................... 217
5.5.5 Bond Rupture Noise Measurement ................................................................. 218
5.5.6 Bond Rupture Experimentation ....................................................................... 222
5.5.7 Limitations .......................................................................................................... 225
5.6 Chapter Conclusion ............................................................................................... 226
6 Conclusions ............................................................................................................. 227

References .................................................................................................................. 229

Appendix A - Experimental Protocol ........................................................................ 235