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To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Ryan K. Leadbetter

“The Quote”

— AUTHOR

Acknowledgements

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Abstract

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Chapter 1

Introduction: Bayesian reliability modelling

Introduction to reliability modelling and the theme of the thesis; which is reliability modelling in the ‘real world’.

1.1 Lifetime analysis

Definition of lifetime analysis.

1.2 Degradation modelling

Definition of degradation modelling.

1.3 Bayesian methods

An overview of Bayesian methods.

Part I

Part one: lifetime analysis

Chapter 2

Using an informative joint prior to combat bias

General introductory part.

2.1 Background

Interlude.

2.1.1 Lifetime distribution

What is lifetime analysis.

2.1.2 The Weibull distribution

Details of the Weibull.

2.1.3 Censoring

What is Censoring?

2.2 Bias in heavily censored lifetime data

Introduce the problem that, when data are heavily censored, the estimates of lifetime parameters become biased. We will show via simulated data so that the underlying truth is known.

2.2.1 Simulation method

How do we simulate censored lifetime data?

2.2.2 Bias in results

How does the estimated CDF differ from the truth?

2.3 Informative Bayesian analysis

How can informative priors help us in this case?

Independent Construction of independent priors.

Joint Construction of the joint prior.

2.3.1 Effect of informative priors

Compare the estimated CDF for the three different models with the truth.

2.4 Discussion

...

Chapter 3

Simulation study

Outline on structure of chapter and what I wish to achieve in the simulation experiment.

3.1 Simulation structure

How do we structure the simulation experiment? What are we testing?

3.2 Results

Visualise/summarise the results of the simulation experiment.

3.3 Discussion

Typical results section.

3.4 Recommendations

What are our recommendations for handling heavily censored data? (which we will implement in the next chapter)

Chapter 4

Case study

A case study.

4.1 Idler replacement data

4.2 Results

4.3 Discusion

Part II

Part two: Degradation modelling

Chapter 5

Noisy gamma process for
modelling degradation
measurements with uncertainty

Chapter 6

Conveyor belt wear forecasting

Chapter 7

Conveyor belt wear forecast with spatial random effect

Appendices

Appendix A

Appendix Title

Appendix B

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Bibliography

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