Review of the thesis

Institution: VŠB – Technical University of Ostrava, Faculty of Electrical Engineering and Computer Science, Department of Applied Mathematics

Thesis title: Stochastic reliability models for maintenance optimization

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Supervisor: Prof. Ing. Radim Briš, CSc.

Opponent: Prof. Ing. Elena Zaitseva, PhD, Faculty of Management Science and Informatics, University of Zilina

The thesis is titled as “Bayes approach to explore the mixture failure rate model” has 110 pages, consists of 8 sections, list of references (bibliography) and list of author’s publications, includes lists of figures, tables, abbreviations. Author consider the problem description, goals of investigation, principal outcomes and outlines of thesis in the section “Introduction”. The analysis of the problem state is presented in section 2 “State of the Art”. The section 3 “Methodology” introduced important background for investigation and principal aspects of the methodology of investigation. The sections from 4 to 7 provides the results of investigation for different applied mathematical approaches. Every of them is illustrated by the experiments and includes analysis of the obtained results. In my opinion, the quality of the text is acceptable, its structure is logical and its message is sufficient clear.

The problem of the investigation is declared clear. The work provides originally Bayesian analysis of some sophisticated models with three or more parameters which result from mixture failure rate. The goal of the investigation is defined as development of Bayes approach for application in mixture failure rate model. The subject of thesis is relevant in reliability engineering and applied mathematics.

This thesis provides originally Bayesian analysis of some sophisticated models with three or more parameters which result from mixture failure rate. The models under analysing are known as the non-linear failure rate model with three parameters, additive Weibull model with four parameters and new modified Weibull model with five parameters. Author demonstrates the effect of parameterization on the Bayes estimators and has applied successfully some Markov chain Monte Carlo methods for exploring the corresponding posterior distributions, and as a result, providing more accurate approximate Bayes estimates.

The indicated goal of investigation is obtained and presented in thesis. The presented result is interesting and agrees with the relevant problem in reliability engineering and applied mathematics. These result allow analysing and evaluation of mixture failure rate. The non-linear failure rate model, the additive Chen-Weibull model and improvement of the new modified Weibull failure rate model have been developed and investigated. The considered applications of proposed results for analysis of failure and running of 30 devices and other benchmark datasets show they importance and relevance for the practice. The important parts of investigation have been published in 8 conferences’ papers that were presented and discussed at well-known international conferences. 3 publications are submitted at the international journal with high IF.
Questions and comments for the author

- According to my point of view, the section 2 “State of the Art” could be extend. Could you show in time of defense: (a) importance of Weibull distribution and (b) application of Weibull models with different number of parameters in reliability engineering?
- Could you propose the practical recommendation for application of proposed models in practice, what number of parameters can be recommended for analysis of typical problems in reliability engineering?

Conclusion of the review

The review of the thesis allows me to recommend this work to the defense and, after successful defense, assign the title “philosophy doctor” (PhD) to Mr. Tien Thanh THACH

Zilina, 29.10.2019

Prof. Ing. Elena Zaitseva, PhD