

國科會「鋰離子電池衰變數據的可靠度分析」整合型計畫特邀演講

**NSTC “Reliability Analysis on the Degradation Data of Li-Ion Battery”
Integrated Project Discussion Meeting
Special Invited Talk I**

Speaker : Professor William Q. Meeker (Distinguished Professor of Statistics, Iowa State University, U.S.A.)

Topic : (1) Seasonal Warranty Prediction Based on Recurrent Event Data
(2) Repeated-Measures Degradation Analysis Using Bayesian Estimation

Date : Taiwan Standard Time: 2022/10/06 (Thursday) 19:30—21:00
USA Iowa Time: 2022/10/06 (Thursday) 6:30—8:00

Meeting WEBEX web link :

<https://nckucc.webex.com/nckucc/j.php?MTID=mc23b1a39beefe25faf3b032e279bfd17>

(In the link page, you may just select “join from your browser” “從您的瀏覽器加入” without installing WEBEX)

Abstract (1)

Warranty return data from repairable systems, such as home appliances, lawnmowers, computers, and automobiles, result in recurrent event data. The non-homogeneous Poisson process (NHPP) model is used widely to describe such data. However, seasonality in the repair frequencies and other variabilities complicate the modeling of recurrent event data. Not much work has been done to address seasonality, and this paper provides a general approach for the application of NHPP models with dynamic covariates to predict seasonal warranty returns. The methods presented here, however, can be applied to other applications that result in seasonal recurrent event data. A hierarchical clustering method is used to stratify the population into groups that are more homogeneous than the overall population. The stratification facilitates modeling the recurrent event data with both time-varying and time-constant covariates. We demonstrate and validate the models using warranty claims data for two different types of products. The results show that our approach provides important improvements in the predictive power of monthly events compared with models that do not take seasonality and covariates into account.

This talk is based on joint work with Qianqian Shan (Amazon) and Yili Hong (Virginia Tech).

Abstract (2)

Degradation data analysis is used to assess the reliability, failure-time distribution, or shelf-life distribution of many different kinds of products including lasers, LEDs, batteries, and chemical and pharmaceutical products. Modeling degradation processes shines a light on the underlying physical-chemical failure mechanisms, providing better justification for the extrapolation that is needed in accelerated testing. Additionally, degradation data provides much richer information about reliability, compared to time-to-event data. Indeed, by using appropriate degradation data it is possible to make reliability inferences even if no failures have been observed. Degradation data, however, bring special challenges to modeling and inference. This talk describes the Repeated Measures Degradation methods in the Second Edition Statistical Methods for Reliability Data and illustrates the implementation of these methods in JMP 17 and in RSplida/Stan. These implementations use state-of-the-art Bayesian hierarchical modeling to estimate failure-time distribution probabilities and quantiles. The methods we present are better grounded theoretically when compared to other existing approaches that have been in common use by engineers (i.e., the pseudo failure time method). Besides advantages, Bayesian methods do pose special challenges, such as the need to specify prior distributions.

This is joint work with Peng Liu, JMP Statistical Discovery LLC.

歡迎參加!! Welcome to join!

主持人：樊采虹老師（中央大學統計研究所）
鄭順林老師（成功大學統計系）

Meeting Hosts :

Prof. Tsai-Hung Fan (Institute of Statistics, National Central University)

Prof. Shuen-Lin Jeng (Department of Statistics and Institute of Data Science,
National Cheng Kung University)

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