Proposal for Special Session at IEEE CASE 2021

Goal:

- Degradation data are an important source of product reliability information. With the rapid developments of sensor and information technologies, the new generation of degradation data features not only large data volumes but also complicated structures. Moreover, many engineering systems are nowadays generating a huge amount of operating and environmental data. These covariates, if jointly utilized with the degradation data, could significantly improve the reliability estimation accuracy. Evidently, the big degradation data and the associated large volume of covariates pose challenges in their statistical analysis. During the recent years, there has been a growing interest in developing tailored statistical models, inference procedures and optimization methods based on the modern degradation data. The ultimate goal is to efficiently and automatically extract product reliability information buried in the big data and facilitate the subsequent decision-making processes.

- This special session mainly focuses on current and emerging topics in modern degradation data analysis, which addresses the original theoretical development and practical applications. In particular, the following three topics are mostly welcomed: 1). Statistical modelling. Given the complex structure and large volume of the degradation data, it is important to develop sophisticated modelling framework which could effectively capture the data structure and the possible covariates. 2). Inference methods. Based on an appropriate statistical model, the next important task is to develop inference methods which could efficiently provide point and interval estimation of the model parameters and important reliability characteristics such as the lifetime distribution and quantiles. 3). Degradation-based maintenance. One important application of the degradation data is to find the optimal maintenance policies. Due to the nature of the big data, scalable optimization tools are highly wanted. This special session is closely related to the topic "Data science and data-driven automation" of CASE 2021.

Session Title: Recent Advances in Degradation Data Analysis

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Contributions:
1. "Maintenance policies for balanced systems subject to degradation" by Xiujie Zhao, Ting Li, Shuguang He. Tianjin University.
2. "Optimal predictive maintenance policy with a degraded sensor", Bin Liu. University of Strathclyde.
3. To be determined.
4. To be determined.