Industrial & Systems Engineering

Seminar Announcement

Failure prediction of advanced high strength steel manufacturing system based on material microstructure

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Abstract: The microstructure of materials determines its behavior and critical failure and quality characteristics in various systems such as manufacturing systems for automotive structures, aircraft engine components, various nanomaterial-based electric/electronic micro-devices, bio-devices and artificial organs. However, in conventional reliability and quality research area, reliability analysis and product quality control usually start from macroscopic level without considering material microstructures. This problem becomes more critical in lightweight autobody manufacturing, where ultra-high strength steels (at 1~1.8GPa strength) and related forming tool materials are used or under development. The failures of the forming tool and steel products are difficult to predict by existing methods without considering material microstructure. This presentation will focus on a general methodology to extract material microstructure information, and further incorporate it to enable accurate failure/reliability prediction and efficient product quality control. The developed methodology integrates reliability engineering, mechanical engineering, and combined experimental and novel statistical methods. The manufacturing system of the advanced high strength steel is used as a case study to illustrate the developed methodology.

Bio: Dr. *Qingyu Yang* is an Assistant Professor in the Dept. of Industrial and Systems Engineering, the director of Reliability and Intelligent System lab, and the co-director of center for Material Process and Manufacturing at Wayne State University. He received his PhD in Industrial Engineering and a Master's degree in Statistics from the University of Iowa. He received another Master's degree in Intelligent System and a bachelor's degree in Automation from the University of Science and Technology of China. Dr. Yang's research interests include advanced material manufacturing, reliability engineering, and complex system diagnosis and prognosis. His research has been supported by National Science Foundation, Dept. of Energy, Dept. of Veteran Affairs, Digital Manufacturing and Design Innovation Institute, Natural Science and Engineering Research Council of Canada, US Automotive Materials Partnership, and Chrysler Corporation. He is the recipient of IIE Transactions Best Paper Award (2011) and ISERC Best Paper Award (2009). He is the advisor and co-author of the ISERC best student paper award (2015) and award finalist (2016).

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