Structural Health Prognostics Using Sparse Bayes Learning Scheme

Abstract: Benefits of Prognostics and Health Management (PHM) to support critical decision-making process can be manifested by effectively implementing prognostics algorithms and accurately predicting the Remaining Useful Lives (RULs) of engineering systems. In general, a prognostics process requires two sequential processes: an offline training (or learning) process and an online prediction process. This talk presents a unified data-driven prognostics framework using the Relevance Vector Machine (RVM) for the offline training process and the Similarity-Based Interpolation (SBI) for the online prediction process. The RVM is a state-of-the-art technique for statistical regression that provides regression coefficients in the form of probabilistic distribution functions (PDFs). Within the proposed prognostics framework, the system health degradation process can be characterized by two health index systems: Physics Health Index (PHI) and Virtual Health Index (VHI). In the offline training process, the RVM is employed for a supervised statistical learning with system training dataset to build background health knowledge (e.g., a predictive health degradation curve) of system units in a statistical form. With this background knowledge, the SBI is then proposed for predicting and continuously updating the RUL in a statistical manner in the online prediction process. The proposed unified prognostics framework is applicable to different engineering applications and its effectiveness is demonstrated with several cases studies (NASA engine system, DC fan, power transformer, and generator static winding).

Biography: Dr. Byeng D. Youn is an assistant professor of Mechanical Engineering at the University of Maryland, College Park. He earned Ph.D. degree from the University of Iowa in 2001, M.S. at KAIST in 1998, and B.S. at Inha University in 1996. His research goal is to develop rational reliability and design methods based on mathematics, physics, and statistics for use in complex engineering systems. His current research includes risk-based design, prognostics and health management (PHM), and energy harvester design. His dedication and efforts in research have garnered substantive peer recognition resulting in four notable awards including ASME IDETC Best Paper Awards (2001, 2008) and ISSMO/Springer Prize for a Young Scientist (2005). He has about 25 journal articles, 65 conference proceedings, and one book chapter in the area of risk analysis and design. His research is currently supported by National Science Foundation (NSF), U.S. Army, LG Electronics, and so on.

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Host: Dr. Youn will be hosted by Professor Peter Sandborn of Mechanical Engineering.