Probabilistic Model-Based Prognostics Using Mesh-Free Modeling

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Abstract: Improved system reliability and reduced maintenance cost are guaranteed if the prediction of remaining useful life (RUL) is deemed to be accurate. Energy systems, like wind turbines, are the primary beneficiaries of this achievement as they tend to suffer from an unexpected early life failure of components that resulted in loss of revenue and high maintenance costs. The issue of uncertainty in prediction of future state is yet a prevailing issue in prognostics and due attention is paramount. Hence, there is a need for establishing a comprehensive framework to quantify uncertainty in prognostics and this talk addresses this issue by considering a research question 'can uncertainty considerations improve the prediction of RUL?' The following specific aims were developed to answer the research question: (1) develop a meshfree cantilever beam with uncertainty in loading conditions, and (2) predict RUL reliably. A probabilistic framework was developed that efficiently predicts remaining useful life of a component using a combination of meshfree model and degradation model. To account for prediction uncertainty, modeling and loading uncertainties are quantified and incorporated in the framework. Some results will be presented.

Biographical Sketch: Stephen Ekwaro-Osire is a full professor in the Department of Mechanical Engineering at Texas Tech University, USA. He has more than 170 publications in journals, conference proceedings, and book chapters. He has graduated 32 doctoral and master's students. His research interests are Dynamics, Engineering Design, and Orthopedic Biomechanics. He is a member of the Society for Design and Process Science, the American Society for Engineering Education, the American Society of Mechanical Engineers, the American Society of Biomechanics, and the Society for Experimental Mechanics.

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