The Prediction of remaining useful life of slurry pumps using Bayesian inference

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Abstract
Slurry pumps are widely used to transfer mixtures of abrasive solids and liquids from one place to another place. Because the impeller of a slurry pump continuously suffers corrosion and erosion, the failure of the impeller causes the breakdown of the slurry pump. In order to prevent any unexpected breakdown, estimation of remaining useful life of the impeller is necessary. In this paper, a prognostic method is developed to infer remaining useful life of the impeller. First, performance degradation assessment of the impeller is conducted based on spectrum analysis of vibration signals collected from a real industrial slurry pump. Second, a state space model consisting of a state evolution function and a measurement function is constructed to track performance degradation process of the impeller. Third, given new coming vibration signals, a general sequential Monte Carlo method, particularly a general particle filter, is employed to update the parameters of the state space model. At last, remaining useful life of the impeller is estimated by extrapolating the updated state space model to an alert threshold which is specified by users’ requirement. Industrial vibration data collected from an oil sand pump are used to illustrate how the developed method works and validate the developed method. The results demonstrate that as more and more vibration data become available, the accuracy of the developed method improves.
About the Speaker
Dong Wang received his M.Phil. (2010) and B.Eng (2007) in Mechatronics Engineering from University of Electronic Science and Technology of China, respectively. He is currently a research postgraduate student supervised by Dr. Peter W. Tse in Department of Systems Engineering and Engineering Management, City University of Hong Kong. He has published 18 journal papers and his work has appeared in various peer-reviewed journals, including Journal of Sound and Vibration, Mechanical Systems and Signal Processing, Journal of Power Sources, Measurement Science and Technology, Review of Scientific instruments, Measurement, Journal of Vibration and Control, Smart Structures and Systems, Applied Soft Computing, etc.. In 2014, He received an Elsevier outstanding reviewer status award in recognition of his contributions made to the quality of the Journal of Sound and Vibration. His main research interests include fault diagnosis and prognosis, nondestructive testing, signal processing, data mining, and Smart material based sensor design.

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