Chin. J. Mech. Eng. (2017) 30:1283–1284
https://doi.org/10.1007/s10033-017-0197-y

EDITORIAL

Special Issue on Machine Fault Diagnostics and Prognostics

Zhigang Tian[1] · Wilson Wang[2]

Published online: 23 October 2017

Machine components and systems, such as gears, bearings, pipes, cutting tools and turbines, may experience various types of faults, such as breakage, crack, pitting, wear, corrosion. If not being properly monitored and treated, such faults can propagate and lead to machinery performance degradation, malfunction, or even severe component/system failure. It is significant to reliably detect machinery defects, evaluate their severity, predict the fault propagation trends, and schedule optimized maintenance and inspection activities to prevent unexpected failures. Advances in these areas will support ensuring equipment and production reliability, safety, quality and productivity. Machine fault diagnostics and prognostics tools have wide potential applications in various industries particularly manufacturing, aerospace, transportation, oil and gas energy. The aim of this special issue on "Machine Fault Diagnostics and Prognostics" is to present new methods and tools for equipment condition monitoring, fault diagnostics, and equipment prognostics aiming at predicting fault propagation and remaining useful life.

As a result of this Call for Papers, over 30 full-length papers were submitted, which passed all rounds of anonymous review processes typical for the *Chinese Journal of Mechanical Engineering*. Ten papers were accepted and included in this special issue.

Induction motor fault diagnosis methods werereported in several papers. For example, Wang et al. proposed an online detection method based on Min-Norm algorithm and least square estimation, to improve precision and calculation speed of fault diagnosis on broken rotorbars in induction motors. Li et al. developed an intelligent harmonic synthesis technique for conducting incipient air-gap eccentricity fault detection in induction motors, and the effectiveness of the proposed technique is examined experimentally.

Advanced signal processing techniques were proposed to recognize representative features for fault detection in machinery systems. Li et al. suggested an adaptive morphological update lifting wavelet method for rolling element bearing fault detection. Jiang et al. investigated vibration based machine fault diagnosis based on unsupervised multiscale representation learning, in order to capture rich and complementary fault pattern information at different scales. Li et al. studied gripper cylinders that provide braced force for a Tunnel Boring Machine; an online empirical mode decomposition based method was proposed for online fault diagnosis. Wang et al. suggested an adaptive change detection method using incremental sliding-window, to recognize structural changes from an operational process for long-term machinery health condition monitoring.

Deep learning was investigated by researchers for machine fault diagnosis. Shao et al. developed a deep learning approach based on deep belief networks, in order to learn features from frequency distribution of vibration signals for the purpose of health condition evaluation of induction motors. Wang et al. investigated a motor fault diagnosis method based on short-time Fourier transform and convolutional neural network; its effectiveness was validated using experimental data.

Fault propagation assessment and prediction methods were also reported in this special issue. Liang et al.

✉ Zhigang Tian
ztian@ualberta.ca

Wilson Wang
wwang3@lakeheadu.ca

[1] University of Alberta, Edmonton, Canada

[2] Lakehead University, Thunder Bay, Canada

investigated gear tooth pitting propagation to neighboring teeth based on a pair of spur gears; tooth pitting propagation assessment was performed using model-based analysis, and statistical features to estimate tooth pitting growth were recommended. Zhao et al. proposed an integrated gear fatigue crack prognostics method to account for two important factors which were not considered before: the uncertainty in crack initiation time and the shock in the degradation.

The Guest Editors would greatly appreciate the authors' excellent contributions to the special issue, and our anonymous reviewers who, with their great efforts and visionary analyses, made it possible not only to select a few successful papers, but also to shape the special issue and to direct the future research on Machine Fault Diagnostics and Prognostics. The Guest Editors would like to thank Ms. Dan Liu, Ms. Ying-Jiao Xiang, and Mr. Fu-Jun Liang for their professional attitude and dedication to the quality of the journal and for the opportunity to shed light on this research area.

Guest Editors

Dr. Zhigang (Will) Tian is currently an Associate Professor at *Department of Mechanical Engineering, University of Alberta, Edmonton, Canada*. He received his B.S. degree in 2000 and M.S. degree in 2003 both from *Dalian University of Technology, China*, and his Ph.D. degree in 2007 from the *University of Alberta, Canada*. His research interests mainly focus on prognostics, pipeline integrity management, reliability engineering, condition based maintenance, renewable energy systems, etc. He has published more than 70 papers in refereed journals and conference proceedings, and has contributed 8 book chapters to several edited books. He received the 2011 Petro-Canada Young Innovator Award. He is a Fellow of the *International Society of Engineering Asset Management (ISEAM)*, and serves as Vice President for the *Reliability, Availability, Maintainability and Safety Professionals Society (RAMSP)*.

Dr. Wilson Wang received his M.Eng. in industrial engineering from the *University of Toronto, Canada* in 1998 and Ph.D. in mechatronics engineering from the *University of Waterloo, Canada* in 2002, respectively. From 2002 to 2004, he was employed as a senior scientist at *Mechworks Systems Inc*. He joined *Lakehead University, Canada* in 2004, and now he is a professor at *Department of Mechanical Engineering, Lakehead University, Canada*. His research interests include signal processing, artificial intelligence, diagnostics and prognostics of machinery health conditions, intelligent control, mechatronics, and smart sensors.