

# **2010 Prognostics and System Health Management Conference**

## **(PHM-2010 Macau)**

**Macao, China**  
**12 – 14 January 2010**



**IEEE Catalog Number: CFP1061H-PRT**  
**ISBN: 978-1-4244-4756-5**

# TABLE OF CONTENTS

<b>A Simple HUMS Approach to Detect Characteristic Variation for Mechanical Systems</b> .....	1
<i>Eric Lee</i>	
<b>Assessment of Local Damages in Box-girder Bridges Using Measured Dynamic Responses by Passing Vehicle</b> .....	9
<i>Z. R. Lu, M. Huang, W. H. Chen, J. K. Liu, Y. Q. Ni</i>	
<b>Research on Electrostatic Monitoring Technology for Aero-engine Gas Path</b> .....	16
<i>Wen Zhenhua, Zuo Hongfu, Daniel Lau, M. Pecht</i>	
<b>A Miniature 3D Stress Measurement Module for In-situ Stress Analysis of Heterogeneous System in Package Devices</b> .....	21
<i>Liam Moore, John Barrett</i>	
<b>Imperfect Predictive Maintenance Model for Multi-State Systems with Multiple Failure Modes and Element Failure Dependency</b> .....	30
<i>Cher Ming Tan, Nagarajan Raghavan</i>	
<b>Solution for Improving Manufacturing Yield and Reliability of Package-on-Package (PoP)</b> .....	42
<i>Bin Xie, Daniel Shi, Tom Chung</i>	
<b>Application of AE Techniques for the Detection of Wind Turbine Using Hilbert-Huang Transform</b> .....	48
<i>Li Lin, Wenxiu Lu, Fulei Chu</i>	
<b>Research into the Quality Control Technology in Machining Process of Enterprise Alliances Based on PHM</b> .....	55
<i>Mingguang Zhao, Yuanliang Zhang</i>	
<b>Failure-counting Based Health Evaluation of a Bus Fleet</b> .....	60
<i>R. Jiang, Yu Zhou</i>	
<b>Condition Classification and Tendency Prediction for Prognostics Using Feature Extraction and Reconstruction</b> .....	64
<i>Dongxiang Jiang, Chao Liu</i>	
<b>Status of Research and Development on Prognostics and Health Management in China</b> .....	71
<i>Shunong Zhang, Rui Kang, Gang Niu, M. Pecht</i>	
<b>Machine Degradation Prognostic Based on RVM and ARMA/GARCH Model for Bearing Fault Simulated Data</b> .....	76
<i>Wahyu Caesarendra, Achmad Widodo, Pham Hong Thom, Bo-Suk Yang</i>	
<b>Study of Ensemble Learning-Based Fusion Prognostics</b> .....	82
<i>Sun Jianzhong, Zuo Hongfu, Yang Haibin, M. Pecht</i>	
<b>An Architecture-Oriented Method of Prognostics and Health Management for C4ISR</b> .....	89
<i>Wei Zhang, Boping Xiao, Yawei Tian, Yilan Mao, Z. Xu</i>	
<b>GA-EMD-SVR Condition Prediction for a Certain Diesel Engine</b> .....	96
<i>Feng Fuzhou, Zhu Dongdong, Jiang Pengcheng, Jiang Hao</i>	
<b>On-line Automatic Early Fault Detection of Rotating Machinery</b> .....	104
<i>Dong Wang, Qiang Miao</i>	
<b>Design of Integrated Aircraft Inflight Safety Monitoring and Early Warning System</b> .....	109
<i>Xiaoyun Wang, Tingdi Zhao</i>	
<b>Health Monitoring Method of Note PC for Cooling Performance Degradation and Load Assessment</b> .....	114
<i>Kenji Hirohata, Katsumi Hisano, Minoru Mukai</i>	
<b>Wavelet Co-efficient of Thermal Image Analysis for Machine Fault Diagnosis</b> .....	121
<i>Ali Md. Younus, Bo-Suk Yang</i>	
<b>Average Life Prediction for Aero-Engine Fleet Based on Performance Degradation Data</b> .....	127
<i>Bai Fang, Zuo Hongfu, Ren Shuhong</i>	
<b>Civil Aero-engine Health Management Integrating with Life Prediction and Maintenance Decision-making</b> .....	133
<i>Xiang Rong, Hongfu Zuo, Zhixiong Chen</i>	
<b>Using Decision Trees in Economizer Repair Decision Making</b> .....	139
<i>Yong Sun, Lin Ma, Warwick Robinson, Colin Fidge</i>	
<b>Design of an Impulse Wavelet for Structural Defect Identification</b> .....	145
<i>Ruqiang Yan, Robert X. Gao</i>	
<b>Maintenance Cost Analysis under Different Inspection Levels for Aircraft Structure</b> .....	151
<i>Jing Cai, Hongfu Zuo, Yi-Ming Xu</i>	
<b>Reliability Evaluation for Specify Factors of Fatigue on Power Device</b> .....	158
<i>Masahiro Kobayashi, Qiang Yu</i>	

<b>The Explicit Hazard Model – Part 1: Theoretical Development</b> .....	164
<i>Nima Gorjian, Lin Ma, Murthy Mittinty, Prasad Yarlagadda, Yong Sun</i>	
<b>The Explicit Hazard Model – Part 2: Applications</b> .....	174
<i>Nima Gorjian, Murthy Mittinty, Lin Ma, Prasad Yarlagadda, Yong Sun</i>	
<b>Wavelet Packet Base Selection for Gearbox Defect Severity Classification</b> .....	181
<i>Qingbo He, Ruqiang Yan, Robert X. Gao</i>	
<b>Filtering and Prediction Techniques for Model-Based Prognosis and Uncertainty Management</b> .....	186
<i>Liang Tang, Jonathan Decastro, Greg Kacprzynski, Kai Goebel, George Vachtsevanos</i>	
<b>An Adapted Brownian Motion Model for Plant Residual Life Prediction</b> .....	196
<i>Wenbin Wang, Matthew Carr</i>	
<b>Bridge Damage Identification by Combining Modal Flexibility and PSO Methods</b> .....	203
<i>Ling Yu, Xi Chen</i>	
<b>An ACO-based Algorithm for Structural Health Monitoring</b> .....	209
<i>Ling Yu, Peng Xu</i>	
<b>A Stochastic Filtering Based Data Driven Approach for Residual Life Prediction and Condition Based Maintenance Decision Making Support</b> .....	216
<i>Wenbin Wang, Matthew Carr</i>	
<b>Application of Support Vector Machine based on Pattern Spectrum Entropy in Fault Diagnostics of Bearings</b> .....	226
<i>Ruijiang Hao, Zhipeng Feng, Fulei Chu</i>	
<b>The ISO 13381-1 Standard's Failure Prognostics Process Through an Example</b> .....	232
<i>Diego A. Tobon-Mejia, Kamal Medjaher, Noureddine Zerhouni</i>	
<b>Methodology of Fault Injection Based on EDA Software</b> .....	244
<i>Dandan Liu, Zhanyong Ren, Mengmeng Liu, Zhaoyang Zeng</i>	
<b>Application of Cyclic Spectral Analysis to Gear Damage Assessment</b> .....	249
<i>Zhipeng Feng, Ruijiang Hao, Fulei Chu, Ming J. Zuo, Mohamed El Badaoui</i>	
<b>Recent Research in Public Health Surveillance and Health Management</b> .....	255
<i>K. L. Tsui, D. Goldsman, W. Jiang, S. Y. Wong</i>	
<b>A PHM System for AEW Radar Based on AOPS-LSSVM Prognostic Algorithm and Expert Knowledge Database</b> .....	262
<i>Guang-Jun Xie, Shi-Qiang Yan, Zi-Yue Tang, Rui Li</i>	
<b>Formalization of Reliability Model for Assessment and Prognosis Using Proactive Monitoring Mechanism</b> .....	268
<i>Feng Ding, Zhengjia He</i>	
<b>Design and Simulation of a Multi-Function MEMS Sensor for Health and Usage Monitoring</b> .....	274
<i>Z. Xu, D. Koltsov, A. Richardson, L. Li, M. Begbie</i>	
<b>Physiological Signal Measuring System via Multiple Communication Protocols</b> .....	281
<i>Yu-Chi Wu, Wei-Hong Hsu, Pei-Fan Chen, Cho-Hsu Chang</i>	
<b>Incipient Fault Diagnosis and Prognosis for Hybrid Systems with Unknown Mode Changes</b> .....	287
<i>Ming Yu, Danwei Wang, Lei Huang</i>	
<b>Automatic Generator Health Assessment System that Embedded with Advanced Fault Diagnosis and Expert System</b> .....	294
<i>Peter W. Tse, Eugene Y. Li, Jeffery C. Chan, Jacko T. Leung</i>	
<b>Enhancing the Ability of Ensemble Empirical Mode Decomposition in Machine Fault Diagnosis</b> .....	301
<i>Wei Guo, Peter W. Tse</i>	
<b>Parametric Study on PCA-based Algorithm for Structural Health Monitoring</b> .....	308
<i>Ling Yu, Jun-Hua Zhu, Liu-Jie Chen</i>	
<b>Research on State Recognition and Wear Lifetime Prediction of Tribo-system</b> .....	314
<i>Juan Li, Hongmao Tu, Qin Liu, Yunpeng Qian</i>	
<b>Nonlinear Characteristic Analysis of Leaf Spring Torsion for The Actuator Loading</b> .....	317
<i>Xunwen Su, Shaoping Wang, Dongmei Zhu, Jian Shi</i>	
<b>Maintenance Decision-Making Using a Continuous-State Partially Observable Semi-Markov Decision Process</b> .....	322
<i>Yifan Zhou, Lin Ma, Joseph Mathew, Yong Sun, Rodney Wolff</i>	
<b>Research Progress on Physics-of-Failure Based Fatigue Stress-Damage Model of Solder Joints in Electronic Packing</b> .....	330
<i>Jiang Shao, Chenhui Zeng, Yun Wang</i>	
<b>Calibration of an Integral Imaging System with a Lenslet Array</b> .....	336
<i>W. Li, Y. F. Li, Z. Yu, K. Wang</i>	
<b>Mode Dependent Threshold for FDI in Hybrid Systems</b> .....	342
<i>Lei Huang, Danwei Wang, Yikai Shi, Ming Yu</i>	

<b>The Application of Wavelet and Time Series Analysis in Quality Monitoring of Digital Signal</b> .....	347
<i>Li Fan</i>	
<b>Research on Indexes and Verification Technology of Airborne PHM System</b> .....	352
<i>Zhaoyang Zeng, Zhanyong Ren, Yueqin Wu</i>	
<b>Methodology of Modeling Applied to Fault Injection Based on EDA</b> .....	358
<i>Mengmeng Liu, Zhanyong Ren, Dandan Liu, Zhaoyang Zeng</i>	
<b>Decision Making Framework for Power Transformer Dissolved Gas Analysis on the basis of Dempster-Shafer Theoretic Approach</b> .....	365
<i>A. Mohd Radzian, M. Itoh</i>	
<b>Distributed Remote Temperature Monitoring and Acquisition System Based on CAN Bus</b> .....	372
<i>Qishen Zhu, Dongmei Zhu, Xunwen Su</i>	
<b>Research of the Military Aircraft Maintenance Support Mode Based on the Prognostics and Health Management</b> .....	376
<i>Deyao Mao, Chuan Lv, Jianming Shi, Yingzhi Zou, Zhiqi Guo</i>	
<b>Prognostics in Switching Systems: Evidential Markovian Classification of Real-Time Neuro-Fuzzy Predictions</b> .....	382
<i>Emmanuel Ramasso, Rafael Gouriveau</i>	
<b>In-Service Reliability Assessment of Solder Interconnect in Power Electronics Modules</b> .....	392
<i>C. Y. Yin, H. Liu, M. Musallam, C. Bailey, C. M. Johnson</i>	
<b>A Neuro-Fuzzy Self Built System For Prognostics: A Way To Ensure Good Prediction Accuracy by Balancing Complexity and Generalization</b> .....	397
<i>Mohamed El-Koujok, Rafael Gouriveau, Nouredine Zerhouni</i>	
<b>RS-485 Serial Port Pseudo-full-duplex Communication Research and Application</b> .....	405
<i>Xunwen Su, Shaoping Wang, Dongmei Zhu, Qishen Zhu</i>	
<b>A Discussion of Using Self-Maintenance Technology to Achieve High Reliability of Equipment</b> .....	410
<i>Mei-Hui Wang, Chuan Lv, Zhao Ma, Dong Zhou</i>	
<b>Application of Prognostic and Health Management Technology on Aircraft Fuel System</b> .....	415
<i>Ting Shen, Fangyi Wan, Weimin Cui, Bifeng Song</i>	
<b>Dispersion and Evaluation of Thermal Fatigue Reliability for Solder Joint by Using Normal Random Numbers</b> .....	422
<i>Toshiaki Maruoka, Qiang Yu, Tadahiho Shibutani</i>	
<b>An Initial Study into the Context of Use of a Web-Based Prognostics Scoring System that Supports the Aged Day-Care Service (ADCS) in Taiwan</b> .....	429
<i>Tin-Kai Chen, Tsung-Li Wang, Jin Duen Tsai</i>	
<b>Hierarchy Clustering Fault Diagnosis of Hydraulic Pump</b> .....	433
<i>Jun Du, Shaoping Wang</i>	
<b>Prognostics of Products Using Time Series Analysis Based on Degradation Data</b> .....	440
<i>Tingting Huang, Li Wang, Tongmin Jiang</i>	
<b>Fault diagnosis method based on D-S evidence theory</b> .....	445
<i>Yueqin Wu, Zhanyong Ren, Zhaoyang Zeng</i>	
<b>Extending Advanced Failure Effects Analysis to Support Prognostics and Health Management</b> .....	449
<i>Shoshanna Rudov-Clark, Adrian Ryan, Chris Stecki, Jacek Stecki, Andrew Hess</i>	
<b>Fusion Approach for Predictive Maintenance of Heritage Structures</b> .....	454
<i>Yasmine Rosunally, Stoyan Stoyanov, C. Bailey, Peter Mason, Sheelagh Campbell, George Monger, Ian Bell</i>	
<b>The Research of Optimal Monitoring Point Placement for Health Monitoring of Dredger Based on Analytic Hierarchy Process</b> .....	460
<i>Yuelel Zhang, Xinpeng Yan, Chengqing Yuan</i>	
<b>Study on Remote Fault Diagnosis System Using Multi Monitoring Methods on Dredger</b> .....	465
<i>Xinpeng Yan, Yuelel Zhang, Chenxing Sheng, Chengqing Yuan</i>	
<b>Study of Diagnosis System Framework Using Remote Knowledge Service</b> .....	469
<i>Jie Liu, Xinpeng Yan</i>	
<b>Prognostics and Health Management for Energetic Material Systems</b> .....	474
<i>Gang Niu, Davinder Anand, M. Pecht</i>	
<b>D-S Evidence Theory based Maintenance Evaluation Under the Situation of Limited Samples</b> .....	481
<i>Liu Liu, Qiang Miao, Yuan Feng</i>	
<b>Monitoring Time-between-Events for Health Management</b> .....	486
<i>Y. J. Xie, K. L. Tsui, M. Xie, T. N. Goh</i>	
<b>Benefits Analysis of Prognostics in Systems</b> .....	494
<i>Bo Sun, Shengkui Zeng, Rui Kang, M. Pecht</i>	
<b>Detection of the Time of Failure of a Hybrid System by Particle Filtering in a Log-Likelihood Ratio Approach</b> .....	502
<i>Francesco Cadini, Giovanni Peloni, Enrico Zio</i>	

<b>Dendritic Growth on the Die under Hermetic High Temperature Operation</b> .....	508
<i>Sheng Zhan, Izhar Ahmad, Ludger Ewald Heurmann-Kuehn, Joerg Baumann</i>	
<b>Physics-of-Failure Approach for Fan PHM in Electronics Applications</b> .....	514
<i>Hyunseok Oh, Michael H. Azarian, M. Pecht, Clifford H. White, Richard C. Sohaney, Edward Rhem</i>	
<b>Improving Computer Manufacturing Management through Lean Six Sigma and PHM</b> .....	520
<i>Gang Niu, Daniel Lau, M. Pecht</i>	
<b>Prognostics-based Health Management for Free Air Cooling of Data Centers</b> .....	527
<i>Jun Dai, Diganta Das, M. Pecht</i>	
<b>Fault Diagnosis of Water Hydraulic Motor by Hilbert Transform and Adaptive Spectrogram</b> .....	533
<i>Chen Hanxin, Hong Yang, Patrick Chua, Lim Geok Hian</i>	
<b>Marine Environmental Damage Effects of Solar Cell Panel</b> .....	539
<i>Chengqing Yuan, Conglin Dong, Liangliang Zhao, Xiping Yan</i>	
<b>Diagnostic Bayesian Networks Auto-construction and Diagnostic Strategy Design Based on Multi-signal Model</b> .....	544
<i>Zhang Shigang, Hu Zheng</i>	
<b>A New Method to Determine Condition Index for Equipment Condition Assessment</b> .....	549
<i>James Young, Lin Ma, Liyuan Wu, Jian Tang, Lin Huo</i>	
<b>Scalable, Synchronized, Energy Harvesting Wireless Sensor Networks</b> .....	555
<i>S. Distasi, C. P. Townsend, J. Galbreath, S. W. Arms</i>	
<b>Condition Monitoring and Fault Diagnostics of Wind Turbines</b> .....	560
<i>Wenxiu Lu, Fulei Chu</i>	
<b>Anomaly Detection of Notebook Computer Based on Weibull Decision Metrics</b> .....	571
<i>Gang Niu, Satnam Singh, Steven W. Holland, M. Pecht</i>	
<b>Operation and Maintenance Support Resources Forecast Model Based on Support Activity Flow</b> .....	577
<i>Jia Wen, Rui Kang, Lin Ma, Yan Wang</i>	
<b>Why Does PHM Matter? – Nvidia’s GPU Problems Reviewed</b> .....	582
<i>Peter K. Rundle</i>	
<b>Predictive Modeling and Experimental Validation of Lead-Free Solder Joint Reliability under Temperature Cycling</b> .....	585
<i>Y. S. Chan, F. Song, C. C. Jeffery Lo, Eddie Lee, S. W. Ricky Lee</i>	
<b>Prognostics and Health Management (PHM) System Requirements and Validation</b> .....	593
<i>Ping Xu, Zili Wang, Yue Li</i>	
<b>Research on Preventive Maintenance Period of Hydroelectric Power Equipments</b> .....	597
<i>Zhong-Zhe Chen, Pei-Yu Ren, Dong Wang</i>	
<b>Implementing Prognostics in Ship-borne Missiles As an Approach to Improve Their Maintenance and Logistic Efficiency</b> .....	600
<i>Weimin Lv, Dong Hu, Jingsong Xie</i>	
<b>Hierarchy Clustering Fault Diagnosis of Hydraulic Pump</b> .....	608
<i>Jun Du, Shaoping Wang</i>	
<b>Developing a Model-Based Software System for Prognostics of Electronic Products and Assemblies</b> .....	615
<i>Jingsong Xie, Zi-Li Wang, Jun-Ke Zhang, Xiao-Zhi Wu, Xiao-Qi Guo</i>	
<b>Prognostics in Wireless Telecare Networks: A Perspective on Serving the Rural Chinese Population</b> .....	623
<i>B. Fong, M. Pecht</i>	
<b>Prognostics and Health Management (PHM) System Requirements and Validation</b> .....	629
<i>Ping Xu, Zili Wang, Yue Li</i>	
<b>Author Index</b>	