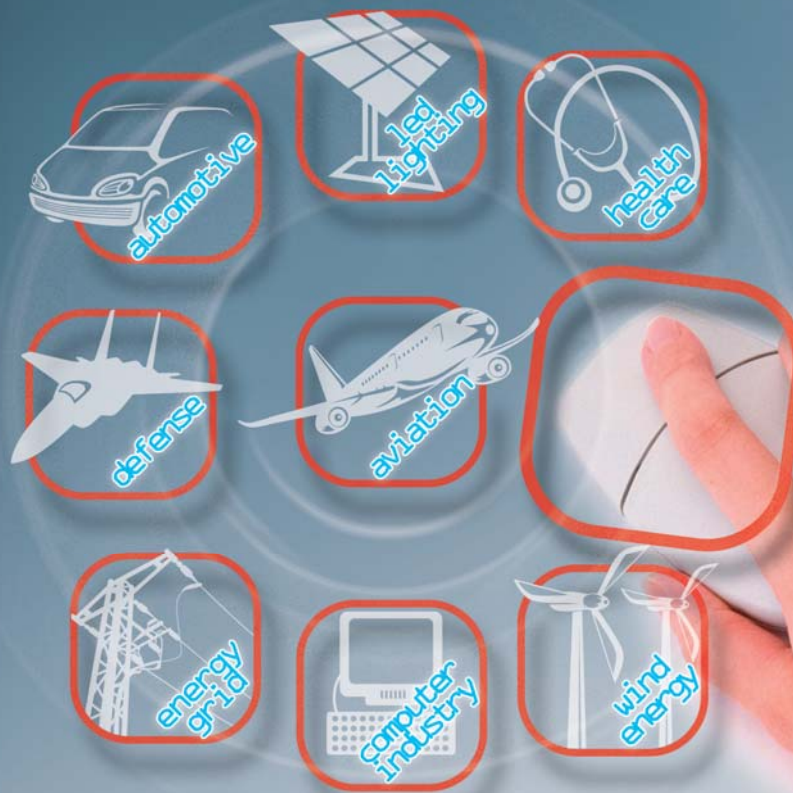


# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



**12-14 January 2010**  
**University of Macau, Macau, China**

Organizers





# PHM-2010 Macau Conference

Prognostics is the process of predicting the future “effective reliability” of a product by assessing the extent of deviation or degradation of a product from its expected normal operating conditions. Health monitoring is the process of measuring and recording the extent of deviation and degradation from a normal operating condition. All the leading companies in the world are looking at the implementation of PHM in their products and systems today.

The aim of the IEEE PHM-2010 Macau conference is to promote the realization and application of PHM as a key enabler for growth for a broad range of industries in the Asia Pacific region. The IEEE PHM-2010 Macau Conference is bringing together the global community of PHM experts from industry, academia, and government in diverse application areas such as avionics and aerospace, marine systems, ground vehicles, power and electronic systems, process industries, computers and telecommunications, material systems, industrial automation, healthcare and medical technology, and many more. This conference will present over 100 papers from institutions and companies around the world.

# Welcome Message



## **Professor Michael Pecht**

General Chair of PHM-2010 Macau Conference  
Visiting Professor and Director:  
CityU Centre for Prognostics and System Health Management (CityU PHM)  
City University of Hong Kong  
Director: CALCE Electronics Products and Systems Center  
University of Maryland

On behalf of the organizing committee, I am delighted to welcome you to 2010 Prognostics and System Health Management Conference (PHM-2010 Macau). This is the first conference of its kind in Asia Pacific to promote the realization and application of PHM, and PHM as a key enabler for growth for a broad range of industries in the Asia - Pacific region.

It is a pleasure to announce that this conference has attracted the global community of PHM experts from industry, academia, and government in diverse application areas including avionics and aerospace, marine systems, process industries, computers and telecommunications, material systems, industrial automation, healthcare and medical technology.

First of all, I would like to thank you the two University Presidents, Professor Wei Zhao and Professor Way Kuo for their continue support to the conference.

The University of Macau is the local host for this event, and without our Co-Chair, Professor Rui Martins and his team's effort, the conference wouldn't have become a reality. I am also very grateful to our financial sponsors for their generous financial contributions to the conference, including Macau Government Tourist Office, University of Macau and IEEE Reliability Society.

I express my sincere appreciation to all members of the Organizing Committee including Professor Rui Kang, Professor Y C Chan and Professor Zhanyong Ren for their excellent work. I also want to thank our session chairs, co-chairs and manuscript reviewers for their hard work to make this conference a big success. Finally, I would like to thank all the authors for their contribution and support, so that we could prepare the conference proceeding successfully.

Overall, the conference is rich in high-quality papers, keynote addresses, sessions and tutorials on hot PHM topics. I wish all the participants a very enjoyable and professionally fruitful experience at PHM-2010 in this pleasant city of Macau.



# Organizing Committee Members



## General Chair

Michael Pecht, PHM Centre - City University of  
Hong Kong and CALCE - University of Maryland

## Co-Chairs

Rui Martins, University of Macau

Rui Kang, Beihang University

Fu Yun, CAPE, Aviation Industry Corporation of China  
(AVIC)

Kong Xue Dong, China Electronic Product Reliability  
and Environmental Testing Research Institute,  
MII (CEPREI)

Chris Bailey, University of Greenwich

Y C Chan, EPA Centre - City University of Hong Kong

## Technical Committee

Keyun Bi, Standing Committee of China Institute of  
Electronics

Peter Rundle, Rundle Law Corporation

Wenbin Wang, University of Salford & PHM Centre -  
City University of Hong Kong

Tom C H Chung, Hong Kong Applied Science and  
Technology Research Institute Company Ltd  
(ASTRI)

Tommy W S Chow, City University of Hong Kong

Peter W T Tse, City University of Hong Kong

Jon Huang, Lenovo Group

Satnam Singh, GM India Science Lab

Sheng Liu, Huazhong University of Science and  
Technology

Andy Tam, Queensland University of Technology

Bo-Suk Yang, Pukyong National University

Hongfu Zuo, Nanjing University of Aeronautics and  
Astronautics

Xinping Yan, Wuhan University of Technology

## Advisory Board

Dave Anand, CECD, USA

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Stephan Lam, IBM Microelectronics Division,  
Hong Kong

Tielin Shi, Huazhong University

Tony Chen, GSMC, China

Wei Chen, Eindhoven University of Technology

Yuk Lam Lo, Hong Kong

Y.L.Wang, Central South University

Zhengjia He, Xi'an Jiaotong University

## Program Committee

Daniel Lau, PHM Centre - City University of  
Hong Kong

Jingsong Xie, Beihang University, China

Bernard Fong, PHM Centre - City University of  
Hong Kong

Qiang Miao, University of Electronic Science and  
Technology of China

Jie Gu, Baker Hughes

Xiaoli Li, Institute for Infocomm Research, Singapore

Gang Niu, PHM Centre - City University of  
Hong Kong

Zhenhua Wan, PHM Centre - City University of  
Hong Kong

## Conference Secretary

Angie Wong, PHM Centre - City University of  
Hong Kong

# Location Map



Conference Venue:

University Library, University of Macau, Av. Padre Tomas Pereira Taipa, Macau

**12 January 2010**

**Tutorials:**

- STDM Auditoriums, G/F, University Library

**13 January 2010**

**Opening Ceremony:**

- STDM Auditoriums, G/F, University Library

**13-14 January 2010**

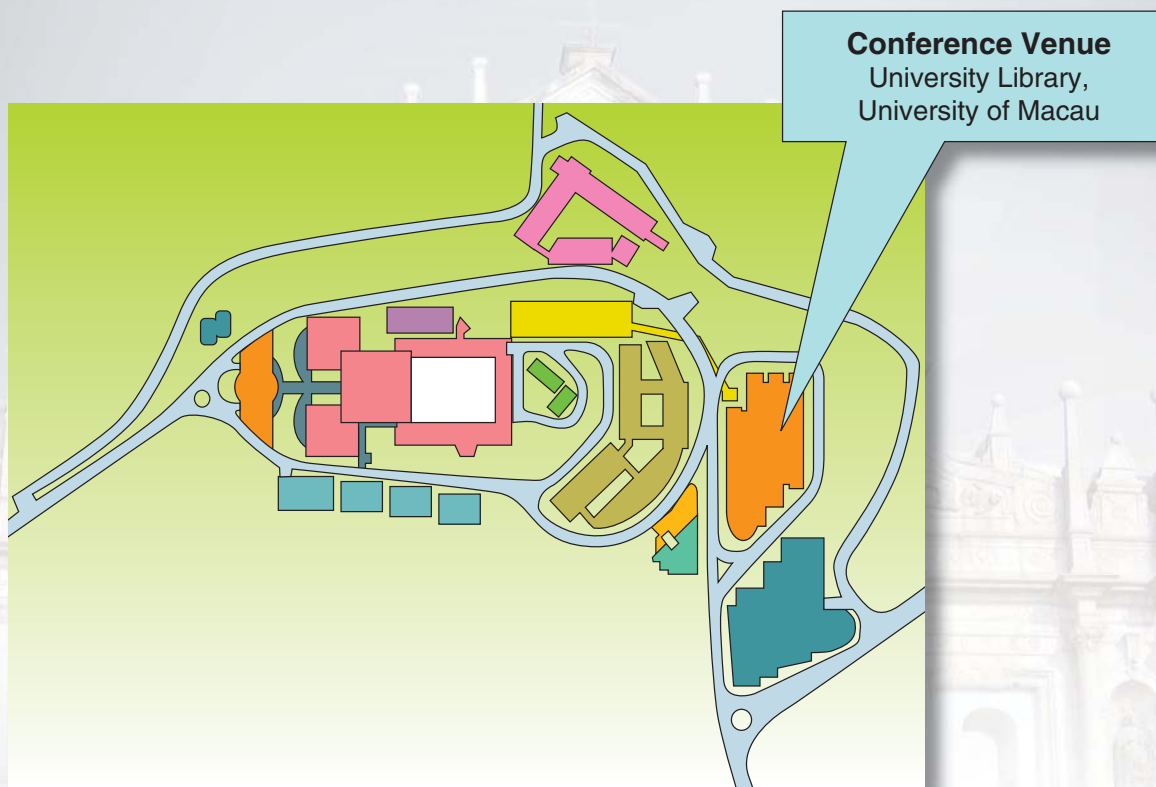
**Presentation Sessions:**

- STDM Auditoriums, G/F, University Library
- Auditoriums II, G/F, University Library
- Room RC02, G/F, University Library
- American Corner, 2/F, University Library

**13-14 January, 2010**

**Lunch and Opening Banquet:**

- Ball Room, Regency Hotel, Macau  
2 Estrada Almirante Marques Esparteiro, Taipa Island, Macau





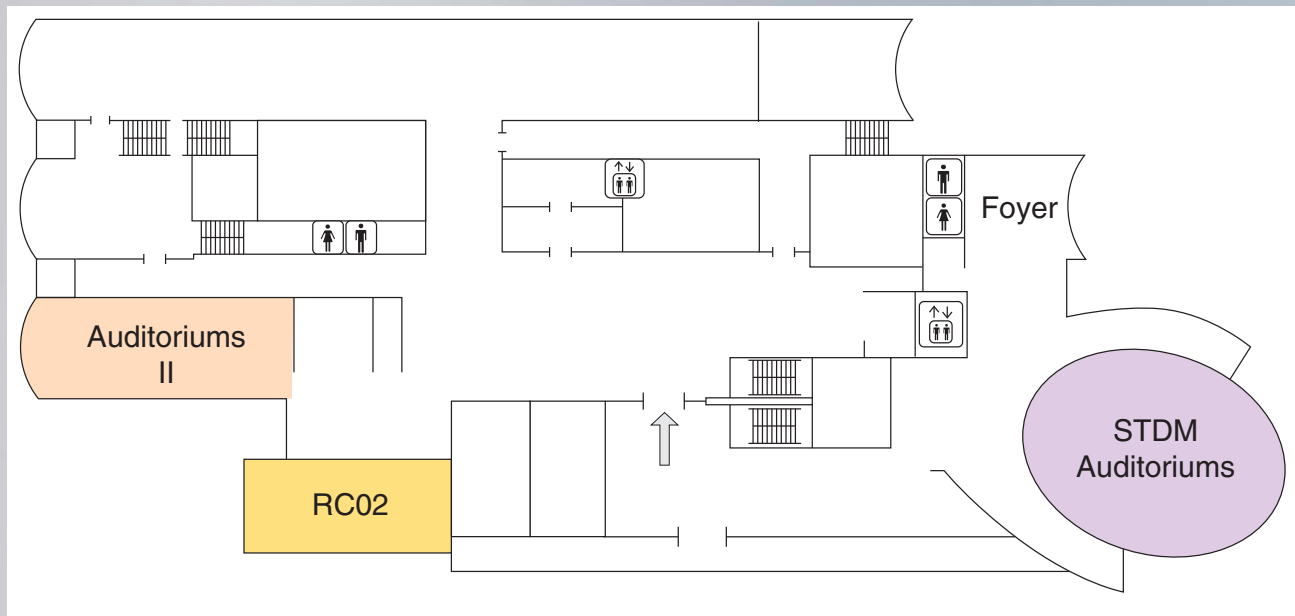
Conference Shuttle Bus Service will be provided between University of Macau and Regency Hotel as the following schedule:

Date	Time
12 January 2010	13:30 – 14:15
12 January 2010	17:00 – 17:30
13 January 2010	08:15 – 09:00
13 January 2010	12:30 – 14:00
13 January 2010	18:00 – 19:00
14 January 2010	08:30 – 09:00
14 January 2010	12:00 – 14:00
14 January 2010	17:00 – 18:00

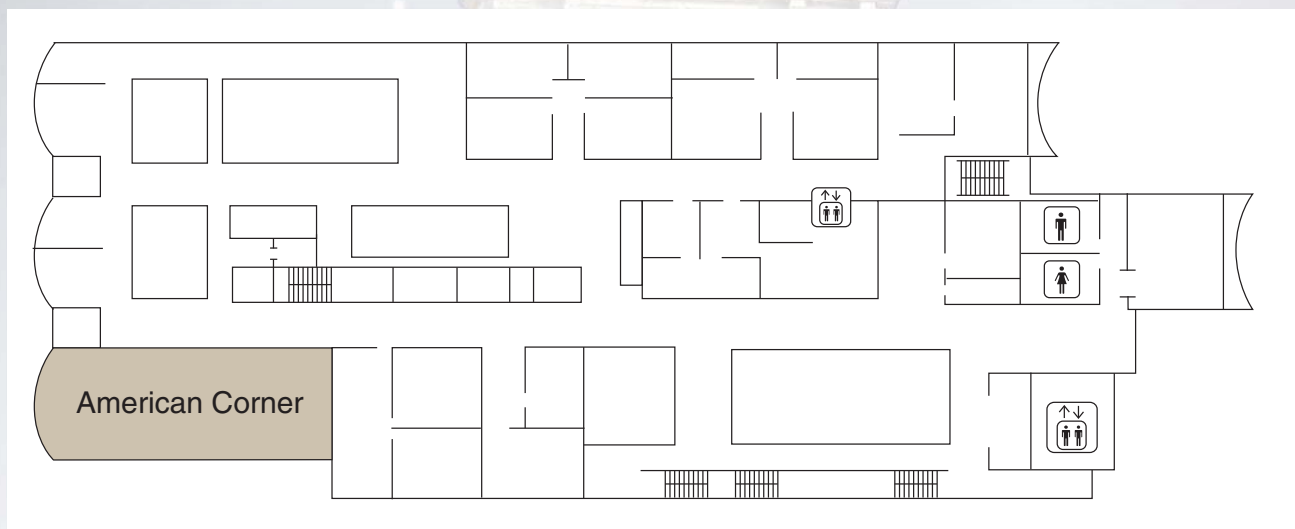


## Floor Plan of University Library, University of Macau

### G/F, STDM Auditoriums, Auditoriums II, Room RC02



### 2/F, American Corner







## Tutorial 1: PHM for Wireless Health Monitoring Networks

**Conducted By: Dr. Bernard Fong, PHM Centre – City University of Hong Kong**

Wireless devices are gaining in popularity as a method for monitoring the health of the human body. Technical advances in small bio-sensors that are worn on patients' bodies and that utilize wireless body area networks can capture data more accurately and can be manufactured more economically. These devices can enable general health assessment of patients, help patients to maintain fitness, aid in rehabilitation, and warn of potentially harmful conditions.

Bio-sensor devices must be supported by reliable wireless communication systems that capture sensor data and relay it for subsequent analysis and storage. Prognostics and health management (PHM) of electronics can play a crucial role in ensuring the reliability of these wireless health monitoring networks.

This tutorial will provide attendees with knowledge of how PHM techniques can be applied to wireless health monitoring networks. The tutorial will cover the factors that affect the reliability of these networks and demonstrate how PHM can successfully address these concerns.

## Tutorial 2: PHM Application for Aviation Industry

**Conducted By: Dr. Zhenhua Wen, PHM Centre – City University of Hong Kong**

Safety and economy are critical objectives for aircraft manufactures and airlines. As to the aircraft, structure, airborne equipments and aero-engine are of paramount importance. Aviation industry will face difficult challenges as it seeks to maintain the highest standards of safety, whilst maximizing profit.

PHM implementation can help the aviation industry to significantly improve safety standard. Relevant PHM technologies and techniques will be presented in this tutorial. In particular, advanced monitoring technologies, diagnostic tools for PHM objectives will be presented and specific illustrations of PHM applications related to aero-engine will be described.

## Tutorial 3: PHM Technology Development towards Data Fusion and Infotronics

**Conducted By: Dr. Gang Niu, PHM Centre – City University of Hong Kong**

PHM/CBM technology has been receiving extensive interests. This tutorial will present the concepts and methods associated with data-driven PHM. Attendees will learn about basic techniques steps and popular tools.

Future PHM developing trend will also be introduced, particularly on the implementation of data fusion techniques. Fusing large amount of mutual information at feature or decision levels can bring about enhanced PHM performances. Attendees will learn about typical data fusion solution and efficient fusion algorithms. Methodology on designing data fusion based health monitoring, diagnostics and prognostics will be introduced, with practical engineering cases. The other character is focusing on infotronics techniques that implement internet, wireless communication, embedded sensors, and intelligent technology. The development of infotronics integrated PHM technology platform is becoming major research direction. Some typical research programs will be introduced.





## - Conference Program -

**Tuesday, 12 January 2010**

**Venue: STDM Auditoriums**

<b>PHM Tutorials</b>	<b>10:00</b>	<b>Registration</b>
	<b>14:00</b>	<b>Tutorial 1: PHM for Wireless Health Monitoring Networks</b>
	<b>15:15</b>	<b>Tutorial 2: PHM Application for Aviation Industry</b>
	<b>16:15</b>	<b>Tutorial 3: PHM Technology Development Towards Data Fusion and Infotronics</b>

**Wednesday, 13 January 2010**

**Venue: STDM Auditoriums**

<b>Opening Ceremony &amp; Keynote Presentations</b>	<b>08:15</b>	<b>Morning Reception</b>
	<b>09:00</b>	<b>Opening Ceremony</b>
	<b>09:05</b>	<b>Opening Address</b> Professor Wei Zhao, Rector of University of Macau, Macau
	<b>09:15</b>	<b>Opening Address</b> Professor Way Kuo, President of City University of Hong Kong, HKSAR
	<b>09:25</b>	<b>Opening Address</b> Professor Rui Martins, Conference Co-Chair Vice Rector of University of Macau, Macau
	<b>09:35</b>	<b>Opening Address</b> Professor Michael Pecht, Conference Chair Visiting Professor & Director of CityU PHM Centre, City University of Hong Kong, HKSAR Director of CALCE, University of Maryland, USA
	<b>10:05</b>	<b>Opening Address</b> Professor Rui Kang, Conference Co-Chair Chair Professor of Beihang University, China
	<b>10:35</b>	<b>Keynote Presentation: PHM, The Key to Enhance Support Capability</b> Professor Zhanyong Ren, Conference Co-organizer Assistant Director of CAPE, Aviation Industry Corporation of China, China
	<b>10:50</b>	<b>Coffee Break</b> at Foyer
	<b>11:05</b>	<b>Keynote Presentation: Guiding Principles and Trends for Prognostics and Health (Quality) Management</b> Professor K C Kapur, University of Washington, USA
	<b>11:25</b>	<b>Keynote Presentation: Why Does PHM Matter? – Nvidia's GPU Problems Reviewed</b> Mr Peter Rundle, Rundle Law Corporation, USA
	<b>11:45</b>	<b>Keynote Presentation: Recent Research in Public Health Surveillance and Health Management</b> Kwok L Tsui, City University of Hong Kong, HKSAR
	<b>12:05</b>	<b>Keynote Presentation: Data, Models and Computation: the Fortune Tellers of Prognostic Health Management</b> Professor Enrico Zio, Dipartimento di Energia – Politecnico di Milano, Italy
	<b>12:25</b>	<b>Lunch at Regency Hotel</b> (shuttle bus service will be provided)

# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



Wednesday, 13 January 2010

Venue: STDM Auditoriums

<b>Session 1A:</b> Computational Modeling and Numerical Analysis – Prognostics (Session Chair: Professor Bo-Suk Yang)	14:00	<b>Keynote Presentation: A Neuro-Fuzzy Self Built System For Prognostics: a Way To Ensure Good Prediction Accuracy by Balancing Complexity and Generalization</b> Rafael Gouriveau, FEMTO-ST Institute, France
	14:20	<b>Prognostics in Switching Systems: Evidential Markovian Classification of Real-Time Neuro-Fuzzy Predictions</b> Rafael Gouriveau, FEMTO-ST Institute, France
	14:40	<b>Machine Degradation Prognostic Based on RVM and ARMA/GARCH Model for Bearing Fault Simulated Data</b> Wahyu Caesarendra, Pukyong National University, South Korea
	15:00	<b>Filtering and Prediction Techniques for Model-Based Prognosis and Uncertainty Management</b> Liang Tang, Impact Technologies, LLC, USA
	15:20	<b>An Adapted Brownian Motion Model For Plant Residual Life Prediction</b> W. B. Wang, University of Salford, UK
	15:40	<b>Prognostics of Products Using Time Series Analysis Based on Degradation Data</b> Tingting Huang, Beihang University, China
	16:00	<b>Study of Ensemble Learning-Based Fusion Prognostics</b> Jianzhong Sun, Nanjing University of Aeronautics and Astronautics, China
	16:20	<b>Coffee Break</b> at Foyer
<b>Session 1B:</b> Computational Modeling and Numerical Analysis – Diagnostics (Session Chair: Professor Enrico Zio)	16:35	<b>Incipient Fault Diagnosis and Prognosis for Hybrid Systems with Unknown Mode Changes</b> Yu Ming, Nanyang Technological University, Singapore
	16:55	<b>Wavelet Co-efficient of Thermal Image Analysis for Machine Fault Diagnosis</b> Md. Younus Ali, Pukyong National University
	17:15	<b>Detection of the Time of Failure of a Hybrid System by Particle Filtering in a Log-Likelihood Ratio Approach</b> Francesco Cadini, Politecnico di Milano, Italy
	17:35	<b>Diagnostic Bayesian Networks Auto-construction and Diagnostic Strategy Design Based on Multi-signal Model</b> Shigang Zhang, National University of Defense Technology, China
	17:55	<b>Failure-counting Based Health Evaluation of Bus Fleet</b> R. Jiang, Changsha University of Science and Technology, China
	18:15	<b>Nonlinear Characteristic Analysis of Leaf Sprint Torsion for the Actuator Loading</b> Xunwen Su, Beijing University of Aeronautics and Astronautics, China

## Welcome Banquet

18:45	<b>Cocktail Reception at Ball Room, Regency Hotel</b> (shuttle bus service will be provided)
19:30	<b>Welcome Banquet at Ball Room, Regency Hotel</b>



**Wednesday, 13 January 2010**

**Venue: Room RC02**

<b>Session 1C:</b> <b>Computational Modeling and Numerical Analysis –</b> <b>Decision Making</b> <b>(Session Chair: Professor K C Kapur)</b>	<b>14:00</b>	<b>Keynote Presentation: Fusion Approach for Predictive Maintenance of Heritage Structures</b> Chris Bailey, University of Greenwich, UK
	<b>14:20</b>	<b>Decision Making Framework for Power Transformer Dissolved Gas Analysis on the Basis of Dempster-Shafer Theoretic Approach</b> Mohd Radzian Abdul Rahman, University of Tsukuba, Japan
	<b>14:40</b>	<b>Using Decision Trees in Economizer Repair Decision Making</b> Yong Sun, Queensland University of Technology, Australia
	<b>15:00</b>	<b>A Discussion of Using Self-Maintenance Technology to Achieve High Reliability of Equipment</b> Mei-Hui Wang, Beijing University of Aeronautics and Astronautics, China
	<b>15:20</b>	<b>Maintenance Decision-Making Using a Continuous-State Partially Observable Semi-Markov Decision Process</b> Yong Sun, Queensland University of Technology, Australia
	<b>15:40</b>	<b>Operation and Maintenance Support Resources Forecast Model Based on Support Activity Flow</b> Jia Wen, Beihang University, China
	<b>16:00</b>	<b>Coffee Break</b> at Foyer
<b>Session 1D:</b> <b>Computational Modeling and Numerical</b> <b>Analysis – Model Development</b> <b>(Session Chair: Professor Tommy Chow)</b>	<b>16:15</b>	<b>The Explicit Hazard Model – Part 1: Theoretical Development</b> Nima Gorjian, Queensland University of Technology, Australia
	<b>16:35</b>	<b>The Explicit Hazard Model – Part 2: Applications</b> Nima Gorjian, Queensland University of Technology, Australia
	<b>16:55</b>	<b>Imperfect Predictive Maintenance Model for Multi-State Systems with Multiple Failure Modes and Element Failure Dependency</b> Cher Ming Tan, Nanyang Technological University, Singapore
	<b>17:15</b>	<b>Mode Dependent Threshold for FDI in Hybrid Systems</b> Ming Yu, Nanyang Technological University, Singapore
	<b>17:35</b>	<b>Formalization of Reliability Model for Assessment and Prognosis Using Proactive Monitoring Mechanism</b> Feng Ding, Xian Technological University, China
	<b>17:55</b>	<b>Equipment PHM Model Construction and Empirical Study</b> Kaiquan Wang, Jiangsu Polytechnic University, China

## Welcome Banquet

<b>18:45</b>	<b>Cocktail Reception at Ball Room, Regency Hotel</b> (shuttle bus service will be provided)
<b>19:30</b>	<b>Welcome Banquet at Ball Room, Regency Hotel</b>



# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



Wednesday, 13 January 2010

Venue: Auditoriums II

<b>Session 2:</b> <b>Computer Health Monitoring and Failure Analysis</b> <b>(Session Chair: Dr. Daniel Lau)</b>	14:00	<b>Keynote Presentation: Physics-of-Failure Approach for Fan PHM in Electronics Applications</b> Hyunseok Oh, CALCE Center, University of Maryland, USA
	14:20	<b>Anomaly Detection of Notebook Computers Based on Weibull Decision Metrics</b> Gang Niu, PHM Center, City University of Hong Kong, HKSAR
	14:40	<b>Health Monitoring Method of Note PC for Cooling Performance Degradation and Load Assessment</b> Kenji Hirohata, Toshiba Corporation, Japan
	15:00	<b>Extending Advanced Failure Effects Analysis to Support Prognostics and Health Management</b> Jacek Stecki, PHM Technology Pty Ltd, Australia
	15:20	<b>Prognostics-based Health Management for Free Air Cooling of Data Centers</b> Jun Dai, CALCE Center, University of Maryland, USA
	15:40	<b>Insight Into Information System Using Data Mining Techniques</b> C H Yang, National Taipei University of Technology, Taiwan
	16:00	<b>Coffee Break</b> at Foyer
<b>Session 3:</b> <b>Interconnect and Package Reliability Assessment</b> <b>(Session Chair: Professor Ricky Lee and Dr. Daniel Lau)</b>	16:15	<b>Keynote Presentation: Predictive Modeling and Experimental Validation of Lead-Free Solder Joint Reliability under Temperature Cycling</b> Ricky Lee, Hong Kong University of Science and Technology, HKSAR
	16:35	<b>In-Service Reliability Assessment of Solder Interconnect in Power Electronics Modules</b> C.Y.Yin, University of Greenwich, UK
	16:55	<b>Reliability Evaluation for Specify Factor of Fatigue on Power Device</b> Masahiro Kobayashi, Yokohama National University, Japan
	17:15	<b>Leadfree and Mixed Assembly Solder Joint Reliability</b> Anocha Sriyarunya, Spansion (Thailand) Ltd
	17:35	<b>Dispersion and Evaluation of Thermal Fatigue Reliability for Solder Joint by Using Normal Random Numbers</b> Toshiaki Maruoka, Yokohama National University, Japan
	17:55	<b>A Miniature 3D Stress Measurement Module for In-situ Stress Analysis of Heterogeneous System in Package Devices</b> Liam Moore, Cork Institute of Technology, Ireland
	18:15	<b>Solution for Improving Manufacturing Yield and Reliability of Package-on-Package (PoP)</b> Bin Xie, Hong Kong Applied Science and Technology Research Institute (ASTRI), HKSAR
	18:35	<b>Reliability Evaluation on 100W QCW-AlGaAs/GaAs 808 nm cm-bars</b> Guoguang Lu, China Electronic Product Reliability and Environmental Test Research Institute, China
<b>Welcome Banquet</b>		
	18:45	<b>Cocktail Reception at Ball Room, Regency Hotel</b> (shuttle bus service will be provided)
	19:30	<b>Welcome Banquet at Ball Room, Regency Hotel</b>



# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



**Wednesday, 13 January 2010**

**Venue: American Corner**

<b>Session 4A:</b> Condition Monitoring, Diagnosis and Prediction (Session Chair: Professor Peter Tse)	<b>14:00</b>	<b>Keynote Presentation: A Stochastic Filtering Based Data Driven Approach for Residual Life Prediction and Condition Based Maintenance Decision Making Support</b> W. B. Wang, University of Salford, UK
	<b>14:20</b>	<b>Design of an Impulse Wavelet for Structural Defect Identification</b> Robert X Gao, University of Connecticut, USA
	<b>14:40</b>	<b>Condition Classification and Tendency Prediction for Prognostics Using Feature Extraction and Reconstruction</b> Dongxiang Jiang, Tsinghua University, China
	<b>15:00</b>	<b>Wavelet Packet Base Selection for Gearbox Defect Severity Classification</b> Robert X Gao, University of Connecticut, USA
	<b>15:20</b>	<b>Enhancing the Ability of Ensemble Empirical Mode Decomposition in Machine Fault Diagnosis</b> Wai Guo, City University of Hong Kong, HKSAR
	<b>15:40</b>	<b>Coffee Break at Foyer</b>
<b>Session 4B:</b> Condition Monitoring, Diagnosis and Prediction (Session Chair: Professor Wenbin Wang)	<b>15:55</b>	<b>Keynote Presentation: Automatic Generator Health Assessment System that Embedded with Advanced Fault Diagnosis and Expert System</b> Peter W. Tse, City University of Hong Kong, HKSAR
	<b>16:15</b>	<b>Dendritic Growth on the Die under Hermetic High Temperature Operation</b> Sheng Zhan, Baker Hughes Incorporated, USA
	<b>16:35</b>	<b>On-line Automatic Early Fault Detection of Rotating Machinery</b> Qiang Miao, University of Electronic Science and Technology of China, China
	<b>16:55</b>	<b>GA-EMD-SVR Condition Prediction for a Certain Diesel Engine</b> Fuzhou Feng, The Academy of Armored Force Engineering, China
	<b>17:15</b>	<b>D-S Evidence Theory based Maintenance Evaluation Under the Situation of Limited Samples</b> Qiang Miao, University of Electronic Science and Technology of China, China
	<b>17:35</b>	<b>Fault Diagnosis Method Based on D-S Evidence Theory</b> Yueqin Wu, China Aero-Polytechnology Establishment, China
	<b>17:55</b>	<b>A Hybrid Feature Selection Scheme for Unsupervised Classification in Machine Defect Detection</b> Yang Yang, Shanghai Jiaotong University, China

## Welcome Banquet

<b>18:45</b>	<b>Cocktail Reception at Ball Room, Regency Hotel</b> (shuttle bus service will be provided)
<b>19:30</b>	<b>Welcome Banquet at Ball Room, Regency Hotel</b>

# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



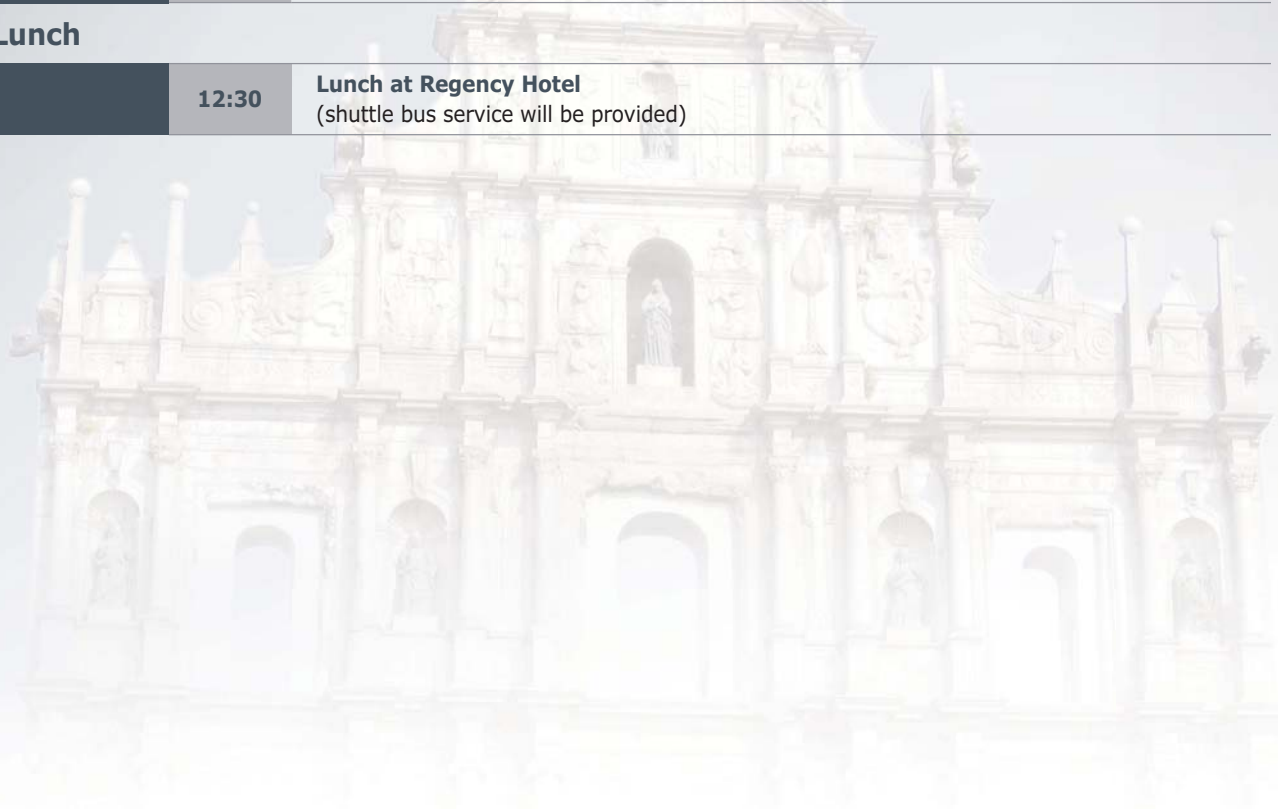
**Thursday, 14 January 2010**

**Venue: Auditoriums II**

<b>Session 4C:</b> <b>Condition Monitoring, Diagnosis and Prediction</b> <b>(Session Chair: Dr. Sai-Weng Sin)</b>	<b>08:30</b>	<b>Morning Reception</b>
	<b>09:00</b>	<b>Keynote Presentation: Study on Remote Fault Diagnosis System Using Multi Monitoring Methods on Dredger</b> Xinping Yan, Reliability Engineering Institute, Wuhan University of Technology, China
	<b>09:20</b>	<b>Keynote Presentation: Condition Monitoring and Fault Diagnostics of Wind Turbines</b> Fulei Chu, Tsinghua University, China
	<b>09:40</b>	<b>Development of Steam Quality Measurement and Monitoring Technique for Low-Pressure Steam Turbines</b> Chayan Mitra, GE-Global Research Centre, India
	<b>10:00</b>	<b>Marine Environmental Damage Effects of Solar Cell Panel</b> Chengqing Yuan, Reliability Engineering Institute, Wuhan University of Technology, China
	<b>10:20</b>	<b>Coffee Break</b> at Foyer
<b>Session 5A:</b> <b>PHM for Aerospace</b> <b>(Session Chair: Dr. Feng Wan)</b>	<b>10:35</b>	<b>Application of Prognostic and Health Management Technology on Aircraft Fuel System</b> Fangyi Wan, Northwestern Polytechnical University, China
	<b>10:55</b>	<b>Research on Electrostatic Monitoring Technology for Aero-engine Gas Path</b> Zhenhua Wen, City University of Hong Kong, HKSAR
	<b>11:15</b>	<b>Research of the Military Aircraft Maintenance Support Mode Based on the Prognostics and Health Management</b> Deyao Mao, Beihang University, China
	<b>11:35</b>	<b>Civil Aero-engine Health Management Integrating with Life Prediction and Maintenance Decision-making</b> Xiang Rong, Nanjing University of Aeronautics & Astronautics
	<b>11:55</b>	<b>Research on Indexes and Verification Technology of Airborne PHM System</b> Zhaoyang Zeng, China Aero-Polytechnology Establishment, China

## Lunch

<b>12:30</b>	<b>Lunch at Regency Hotel</b> (shuttle bus service will be provided)
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# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



**Thursday, 14 January 2010**

**Venue: Room RC02**

<b>Session 6:</b> <b>Standard and Framework</b> <b>(Session Chair: Dr. Bruno Foucher)</b>	08:30	<b>Morning Reception</b>
	09:00	<b>Keynote Presentation: Description of the TRIADE Programme of the European Framework 7: New Technology Building Blocks for Data Acquisition and Processing</b> Bruno Foucher, EADS Innovation Works, France
	09:20	<b>The ISO 13381-1 Standard's Failure Prognostics Process Through an Example</b> Diego A Tobon-Mejia, FEMTO-ST Institute, France
	09:40	<b>Study of Diagnosis System Framework Using Remote Knowledge Service</b> Chengqing Yuan, Reliability Engineering Institute, Wuhan University of Technology, China
	10:00	<b>Improving Computer Manufacturing Management Through Lean Six Sigma and PHM</b> Daniel Lau, City University of Hong Kong, HKSAR
	10:20	<b>Coffee Break</b> at Foyer
	10:35	<b>Status of Research and Development on Prognostics and Health Management in China</b> Shunong Zhang, Beihang University, China
	10:55	<b>An Architecture-Oriented Method of Prognostics and Health Management for C4ISR</b> Wei Zhang, Beihang University, China
	11:15	<b>Prognostics and Health Management (PHM) System Requirements and Validation</b> Ping Xu, Beijing University of Aeronautics and Astronautics

## Lunch

	12:30	<b>Lunch at Regency Hotel</b> (shuttle bus service will be provided)
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**Thursday, 14 January 2010**

**Venue: American Corner**

<b>Session 7:</b> <b>Structural Health Monitoring</b> <b>(Session Chair: Professor Qiang Miao)</b>	08:30	<b>Morning Reception</b>
	09:00	<b>Distributed Remote Temperature Monitoring and Acquisition System Based on CAN Bus</b> Qishen Zhu, Nanjing Institute of Industry Technology, Southeast University, China
	09:20	<b>The Research of Optimal Monitoring Point Placement for Health Monitoring of Dredger Based on Analytic Hierarchy Process</b> Chengqing Yuan, Reliability Engineering Institute, Wuhan University of Technology, China
	09:40	<b>An ACO-based Algorithm for Structural Health Monitoring</b> Ling Yu, Jinan University, China
	10:00	<b>Parametric Study on PCA-based Algorithm for Structural Health Monitoring</b> Ling Yu, Jinan University, China
	10:20	<b>Coffee Break</b> at Foyer
	10:35	<b>Research on Preventive Maintenance Period of Hydroelectric Power Equipments</b> Zhong-Zhe Chen, University of Electronic Science and Technology of China
	10:55	<b>Calibration of an Integral Imaging System with a Lenslet Array</b> Y. Li, City University of Hong Kong, HKSAR
	11:15	<b>Research on the Deflection of the Annular Throttle Slice of Shock Absorber</b> Yi-Jie Chen, China North Vehicle Research Institute, China

## Lunch

	12:30	<b>Lunch at Regency Hotel</b> (shuttle bus service will be provided)
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# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



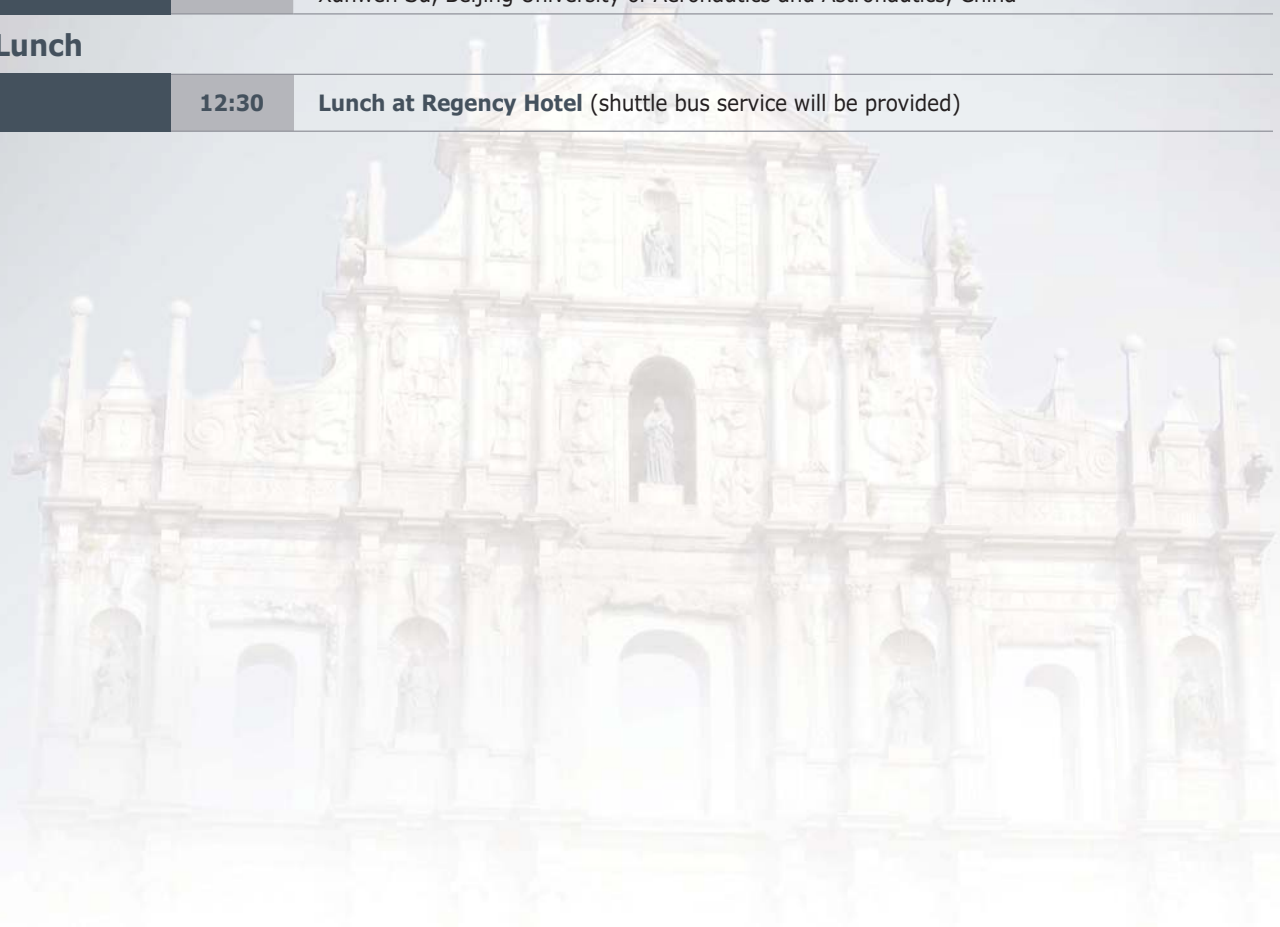
**Thursday, 14 January 2010**

**Venue: STDM Auditoriums**

<b>Session 8A:</b> <b>Advanced Sensor and Detection Technologies</b> <b>(Session Chair: Dr. Pui-In Mak)</b>	<b>08:30</b>	<b>Morning Reception</b>
	<b>09:00</b>	<b>Keynote Presentation: Design and Simulation of a Multi-Function MEMS Sensor for Health and Usage Monitoring</b> Zhou Xu, Lancaster University, UK
	<b>09:20</b>	<b>Keynote Presentation: Scalable, Synchronized, Energy Harvesting Wireless Sensor Networks</b> Stephen DiStasi, MicroStrain, Inc, USA
	<b>09:40</b>	<b>Application of AE Techniques for the Detection of Wind Turbine Using Hilbert-Huang Transform</b> Li Lin, Tsinghua University, China
	<b>10:00</b>	<b>A Simple HUMS Approach to Detect Characteristic Variation for Mechanical Systems</b> Eric Lee, Defence Science and Technology Organisation (DSTO), Australia
	<b>10:20</b>	<b>Coffee Break at Foyer</b>
<b>Session 8B:</b> <b>Advanced Sensor and Detection Technologies</b> <b>(Session Chair: Dr. Gang Niu)</b>	<b>10:35</b>	<b>A New Method to Determine Condition Index for Equipment Condition Assessment</b> James Young, Beijing University of Aeronautics and Astronautics, China
	<b>10:55</b>	<b>Turbopump Condition Monitoring Using Novelty Detection Methods</b> Lei Hu, National University of Defense Technology, China
	<b>11:15</b>	<b>Application of Support Vector Machine based on Pattern Spectrum Entropy in Fault Diagnostics of Bearings</b> Rujia Hao, Shijiazhuang Railway Institute, China
	<b>11:35</b>	<b>RS-485 Serial Port Pseudo-full-duplex Communication Research and Application</b> Xunwen Su, Beijing University of Aeronautics and Astronautics, China

## Lunch

	<b>12:30</b>	<b>Lunch at Regency Hotel</b> (shuttle bus service will be provided)
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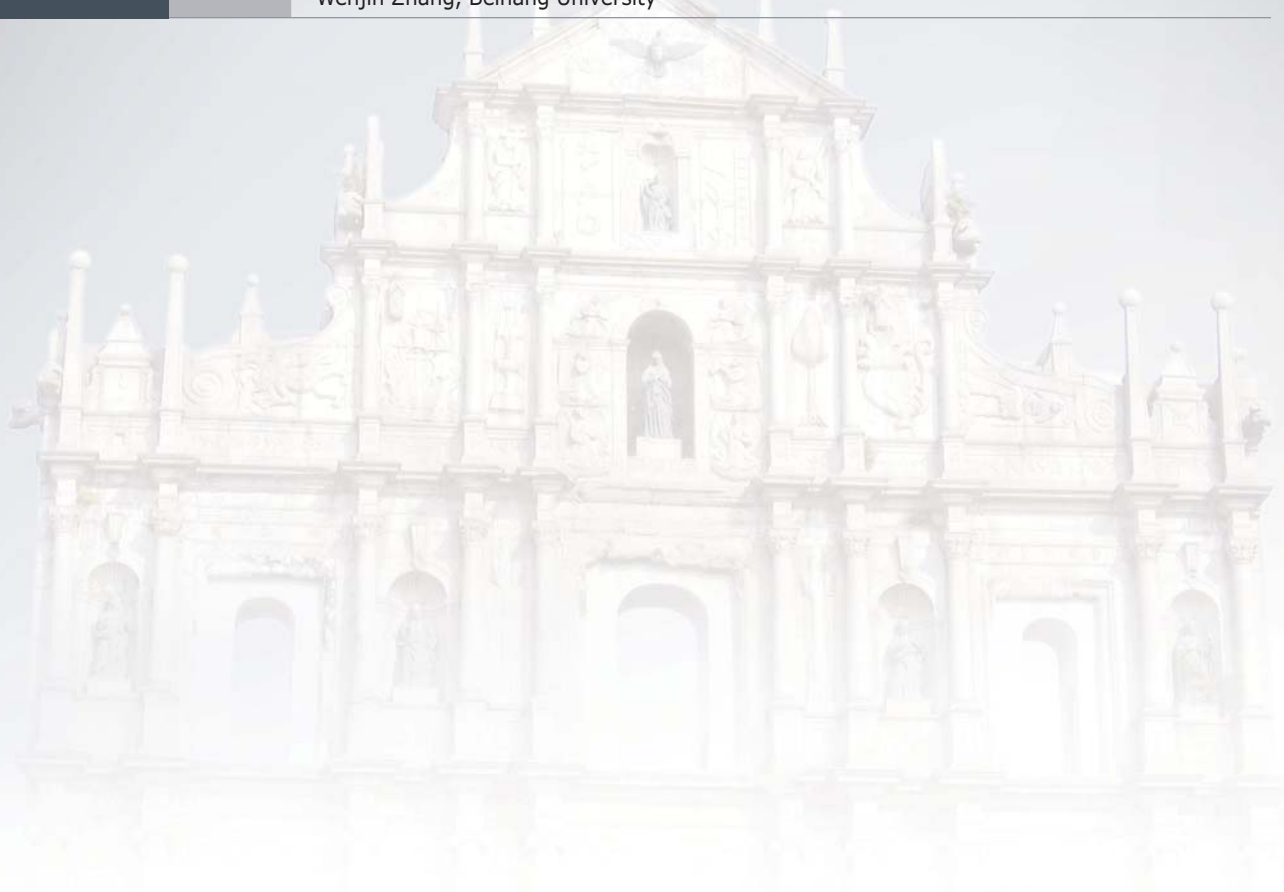
# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



**Thursday, 14 January 2010**

**Venue: Auditoriums II**

<b>Session 9: Quality Control and Health Management (Session Chair: Dr Daniel Lau)</b>	<b>14:00</b>	<b>Monitoring Time-between-Events for Health Management</b> Yujuan Xie, Industrial & System Engineering Department, National University of Singapore, Singapore
	<b>14:20</b>	<b>The Application of Wavelet and Time Series Analysis in Quality Monitoring of Digital Signal</b> Fan Li, China Aero-Polytechnology Establishment, China
	<b>14:40</b>	<b>Prognostics and Health Management for Energetic Material Systems</b> Gang Niu, PHM Center, City University of Hong Kong, HKSAR
	<b>15:00</b>	<b>Benefits Analysis of Prognostics in Systems</b> Bo Sun, Beihang University, China
	<b>15:20</b>	<b>Coffee Break</b>
<b>Session 10: Product Development and Field Deployment (Session Chair: Dr. Jingsong Xie)</b>	<b>15:35</b>	<b>Implementing Prognostics in Ship-borne Missiles as an Approach to Improve Their Maintenance and Logistic Efficiency</b> Weimin Lv, Beijing University of Aeronautics and Astronautics, China
	<b>15:55</b>	<b>Developing a Model-Based Software System for Prognostics of Electronic Products and Assemblies</b> Jingsong Xie, Beijing University of Aeronautics and Astronautics, China
	<b>16:15</b>	<b>Hierarchy Clustering Fault Diagnosis of Hydraulic Pump</b> Jun Du, Beihang University, China
	<b>16:35</b>	<b>The Applications of Ultra-high-rise Building Structural Health Monitoring Technique and Temperature Monitoring Technique in the Canton Tower Project</b> Cui Xiaoqiang, Shanghai Construction (Group) Co, China
	<b>16:55</b>	<b>Application of PHM to Construct UAV Agile Support System</b> Wenjin Zhang, Beihang University



# 2010 Prognostics & System Health Management Conference (PHM-2010 Macau)



**Thursday, 14 January 2010**

**Venue: Room RC02**

<b>Session 5B:</b> <b>PHM for Aerospace</b> <b>(Session Chair: Dr. Zhenhua Wen)</b>	<b>14:00</b>	<b>Methodology of Modeling Applied to Fault Injection Based on EDA</b> Mengmeng Liu, China Avic Aero-Polytechnology Establishment, China
	<b>14:20</b>	<b>Maintenance Cost Analysis Under Different Inspection Levels for Aircraft Structure</b> Jing Cai, Nanjing University of Aeronautics and Astronautics, China
	<b>14:40</b>	<b>Hierarchy Clustering Fault Diagnosis of Hydraulic Pump</b> Jun Du, Beihang University, China
	<b>15:00</b>	<b>Design of Integrated Aircraft Inflight Safety Monitoring and Early Warning System</b> Xiaoyun Wang, Beijing University of Aeronautic and Astronautic, China
	<b>15:20</b>	<b>Coffee Break</b>
	<b>15:35</b>	<b>Average Life Prediction for Aero-Engine Fleet Based on Performance Degradation Data</b> Bai Fang, Nanjing University of Aeronautics and Astronautics, China
	<b>15:55</b>	<b>Methodology of Fault Injection Based on EDA Software</b> Dandan Liu, China Avic Aero-polytechnology Establishment (AVIC CAPE), China
	<b>16:15</b>	<b>A Prognostics Approach of Turbofan Engine based on Components Health Estimation</b> Yu-bin Zhu, Chinese Academy of Sciences, China

**Thursday, 14 January 2010**

**Venue: American Corner**

<b>Session 11:</b> <b>Damage Assessment</b> <b>(Session Chair: Dr. Peng-Un Mak)</b>	<b>14:00</b>	<b>Application of Cyclic Spectral Analysis to Gear Damage Assessment</b> Zhipeng Feng, University of Science and Technology Beijing, China
	<b>14:20</b>	<b>Research Progress on Physics-of-Failure Based Fatigue Stress-Damage Model of Solder Joints in Electronic Packing</b> Jiang Shao, China Aero-Polytechnology Establishment, China
	<b>14:40</b>	<b>Assessment of Local Damages in Box-girder Bridges Using Measured Dynamic Responses by Passing Vehicle</b> Z.R.Lu, Sun Yat-sen University, China
	<b>15:00</b>	<b>Bridge Damage Identification by Combining Modal Flexibility and PSO Methods</b> Ling Yu, Jinan University, China
	<b>15:20</b>	<b>The Damage Detection of the Bridge Based on the Pseudo Multi-Objective Genetic Algorithm with Fuzzy Optimum Selection Theory</b> Xue-Jun Zhang, Nanyang Institute of Science and Technology, China
<b>Session 12:</b> <b>Healthcare and Medical Technologies</b> <b>(Session Chair: Dr. Bernard Fong)</b>	<b>15:40</b>	<b>Coffee Break</b>
	<b>15:55</b>	<b>Prognostics in Wireless Telecare Networks: A Perspective on Serving the Rural Chinese Population</b> Bernard Fong, City University of Hong Kong, HKSAR
	<b>16:15</b>	<b>Physiological Signal Measuring System via Multiple Communication Protocols</b> Yu-Chi Wu, National United University, Taiwan
	<b>16:35</b>	<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> Tin-Kai Chen, SHU-TE University, Taiwan (ROC)





# 中国故障预测与健康管理学会 China PHM Society

**The China Prognostics and Health Management Society (CPHM)** is a non-profit organization established to address the key needs of the Chinese community relating to the education and application of quality, reliability, maintainability, safety and sustainability.

**Prognostics** are an engineering discipline focused on predicting the future condition of a component and/or system of components. The science of prognostics is based on the analysis of failure modes, detection of early signs of wear and aging in complex systems and components, and correlation of these signs with an aging profile (or model). Potential uses for prognostics include estimation of remaining useful life and condition-based maintenance. The discipline that links studies of failure mechanisms to system lifecycle management is often referred to as **Prognostics and Health Management (PHM)**. Technical approaches to prognostics can be categorized broadly into data-driven approaches, model-based approaches, and hybrid approaches.

During the last few years, many leading companies in the world have been applying PHM from product design to supply chain management and have already established a fruitful Return-Of-Investment (ROI) in this regard. The market applications are wide ranging.

Our efforts are to raise the Chinese awareness in terms of sustainable development in industry, government organizations and academic community through diagnostics, prognostics and system's health management. The CPHMS Committee is particularly focused on the partnership development with industry and research institutions which are our key drivers in PHM research application and human capital development for China and Asia Pacific Region.

In this manner, we will have more ability and opportunity to share information, industrial research cooperation and to conduct exchange in all forms that will benefit all members.

## AIMS

1. Raise the overall awareness of PHM methodology, technology and its application to industries in China, especially in the areas of avionics and aerospace maintenance, computers, telecommunications, automobiles and trains, power supply systems and the energy grid, LED lightings, health care and medical devices.
2. Create strategic partnership between academics-industry-government in China and Asia Pacific Region.
3. Promote exchanges between China PHM community and international partners for experience sharing.
4. Develop PHM education programs and professional courses for industries, students and government organizations.
5. Provide a platform to share PHM expertise with members of the society.
6. Foster PHM project creation and cooperation among various organizations.
7. Promote technology transfer of PHM applications.
8. Provide a knowledge domain of latest PHM information, events, publication and programs in PHM in China and around the world.

## INVITATION TO PARTICIPATE

We cordially invite any professionals and interest party to contact us to take part in this exciting opportunity to work together to make the China PHM Society a win-win success for all. There are three types of Membership: Corporate Membership, Academic Membership and Student Membership. Please visit China PHM Society's website for details > [www.chinaphm.com](http://www.chinaphm.com).



## SOCIETY ORGANIZATION

**The Founding Chairman** is Professor Rui Kang of Beihang University in Beijing. There are six Vice-Chairmen who are leaders in each initiative as shown in the organization chart.

**The International Advisory Board** are made up of members of international standing in their area of expertise and the objective of the advisory is to bring together worldwide experience for the development of the China PHM Society. The Board will advise on strategy, key partnership and program that will enable the continual success of the Society.

### **The International Advisory Board Members:**

**Professor Kapur, Kailash (Kal) C.**

Professor and Director of Industrial Engineering, College of Engineering, University of Washington, Seattle, Washington

**Professor Park, Dong Ho**

Professor at Hallym University, Chuncheon, Korea

**Professor Pecht, Michael**

Visiting Professor and Director:

CityU Centre for Prognostics and System Health Management (CityU PHM)

City University of Hong Kong

Director: CALCE Electronics Products and Systems Center  
University of Maryland

**Professor Tan, Andy CC**

Professor of the School of Engineering Systems, Queensland University of Technology, Australia

**Dr. Uckun, Serdar**

Founder and President of the PHM Society, USA

**Professor Xie, Min**

Professor of Department of Industrial and Systems Engineering,  
National University of Singapore, Singapore

**Professor Zio, Enrico**

Professor of Computational Methods for Safety and Risk Analysis  
Director of the Graduate School of the Politecnico di Milano, Italy

**Professor Zuo, Mingjian**

Professor of the Department of Mechanical Engineering, University of Alberta, Canada

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**Website: <http://www.chinaphm.com>**



# Diagnostics, Prognostics and System's Health Management

By Michael Pecht and Kang Rui

## The First IEEE Authorized PHM Book in Chinese

*Prognostics and Health Management (PHM) is of key importance to the future of structural and information systems, including the electronics that comprise such systems. The Electronic Manufacturing and Packaging Technology Society of Chinese Institute of Electronics (CIE-EMPT) has a publication series on electronics packaging which includes PHM as part of the series publication. The Society has scheduled the book "Diagnostics, Prognostics and System's Health Management (故障诊断、预测与系统健康管理)" by Professor Michael Pecht and Professor Kang Rui into its series of books on electronic packaging.*

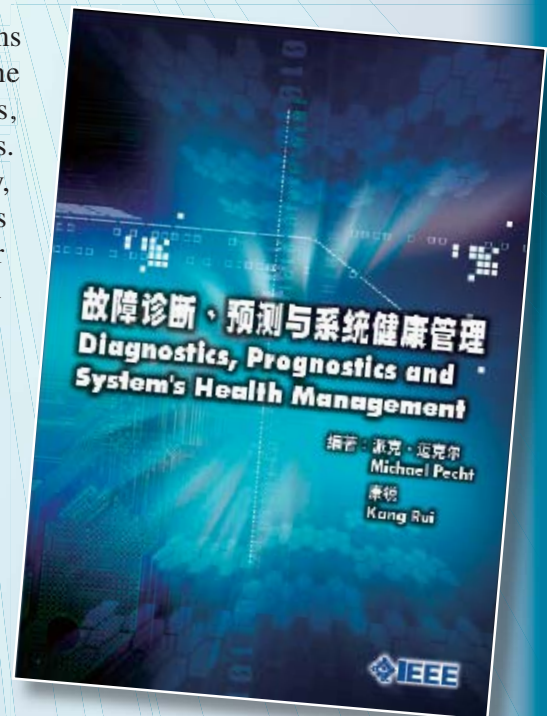
*The Electronic Manufacturing and Packaging Technology Society of  
Chinese Institute of Electronics (CIE-EMPT)*

Recently, the field of prognostics for components, systems and products has received increased attention due to the potential to provide early warning of system failures, forecast maintenance as needed, and reduce life cycle costs. In response to the subject's growing interest among industry, government, and academic professionals, this book provides a road map to the current challenges and opportunities for research and development in Diagnostics, Prognostics and System's Health Management (PHM).

Readers can use the information in this book to:

- Detect and isolate faults
- Reduce the occurrence of No Fault Found (NFF)
- Provide advanced warning of system failures
- Enable condition-based (predictive) maintenance
- Obtain knowledge of load history for future design, qualification, and root cause analysis
- Increase system availability through an extension of maintenance cycles and / or timely repair actions
- Subtract life cycle costs of equipment from reduction in inspection costs, down time, and inventory

Diagnostics, Prognostics and System's Health Management is an indispensable reference for engineers in manufacturing, systems maintenance, and management, as well as design engineers in all areas of electronics.



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