2022 Prognostics and Health Management Conference (PHM-2022 London)

London, United Kingdom 27-29 May 2022



IEEE Catalog Number: CFP22W12-POD **ISBN:**

978-1-6654-7955-4

Copyright © 2022 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

*** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

CFP22W12-POD
978-1-6654-7955-4
978-1-6654-7954-7
2166-563X

Additional Copies of This Publication Are Available From:

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400 Fax: (845) 758-2633 E-mail: curran@proceedings.com Web: www.proceedings.com



2022 Prognostics and Health Management Conference (PHM-2022 London) **PHM-London 2022**

Table of Contents

Message from the General Chair	xvii
Organizing Committee	xviii
Reviewers	xix
Sponsors	xxi

2022 Prognostics and Health Management Conference

 Fault Prediction of Fire Control System Based on Grey Rough set and BP Neural Network 1 Baoqi Xie (Guangxi University of Science and Technology, China), Yingshun Li (Dalian University of Technology, China), Haiyang Liu (Shenyang Shunyi Technology Co., China), Xingru Kang (Shenyang Shunyi Technology Co., China), and Yang Zhang (Shenyang Shunyi Technology Co., China)
A New Method of Aero-Engine Bearing Fault Diagnosis Based on EMD Decomposition
Fault Diagnosis of fire Control System Based on Genetic Algorithm Optimized BP Neural
Network11Yingshun Li (Dalian University of Technology, China), Xiuyu Hu11(Guangxi University of Science and Technology, China), Zhao Yao12(Dalian University of Technology & NCO Institue of Armored Force, China), and Yang Zhang (Shenyang Shunyi Technology Co., China)
Fault Diagnosis Method for Complex Electronic System17Zhenwei Zhou (China Electronic Product Reliability and Environmental Test Institute, China), Tong Li (Xidian University, China), Tao Liu (Hongfujin Precision Eletronics(Yantai) Limitted Company, China), Kaiwei Wang (China Electronic Product Reliability and Environmental Test Institute, China), Yun Huang (China Electronic Product Reliability and Environmental Test Institute, China), Yun Huang (China Electronic Product Reliability and Environmental Test Institute, China), and Linlin Shi (China Electronic Product Reliability and Environmental Test Institute, China)
 Health Assessment of Turnout System Based on Mahalanobis Distance

A Damage Detection Method for Plate Structures Based on Dynamic Strain Measurements 27 Yangyang Ding (Wuhan University of Technology, China), Jieming Yin (Wuhan University of Technology, China), Wenlin Liao (China Aerodynamics Research and Development Centre, China), and Liu Hong (Wuhan University of Technology, China)
A Relation Prediction Method for Industrial Knowledge Graph with Complex Relations
The Calculation of Extreme Condition of Telescopic Boom of Drilling Jumbo Based on New Biogeography-Based Optimization Algorithm
A Feature Representation Method Based on Dual Segment and Entropy Evaluation for Aeroengine Gas Path Anomaly Detection
A Diesel Engine Assembly Quality Detection Method Based on Cross-Point Frequency Response and Static and Dynamic Information Fusion
 Supercapacitor Early Degradation Behavior Under High Temperature Accelerated Calendar Ageing Test
The Coupled Vibration Response Analysis of Gearbox with a Bearing Localized Defect
An Adaptable UAV Sensor Data Anomaly Detection Method Based on TCN Model Transferring 73
Jingting You (Harbin Institute of Technology, China), Jun Liang (Harbin Institute of Technology, China), and Datong Liu (Harbin

Institute of Technology, China)

Research on DC Microgrid Simulation for Marine Energy and Implementation of RT-LAB Semi-Physical Simulation
Zhiyong Zhou (Ocean University of China, China), Liqiang Zhang (Ocean University of China, China), Xianye Zhu (Shandong Marine Forecast and
Hazard Mitigation Service, China), Zhen Chen (Ocean University of China, China), and Ming Li (Ocean University of China, China)
SOC Estimation for Lithium-ion Battery Based on Model-in-the-Loop for Embedded System Test 83
Yu Xu (Ocean University of China, China), Liqiang Zhang (Ocean University of China, China), Xianye Zhu (Shandong Marine Forecast and Hazard Mitigation Service, China), Xiangyu Wang (Ocean University of China, China), and Ming Li (Ocean University of China, China)
Exchange Problem Optimization Between Aeroengines with Multiple Modules and Life-Limited Parts
Bin Yu (Harbin Institute of Technology at Weihai, China), Xuyun Fu (Harbin Institute of Technology at Weihai, China), Wei Jiang (Harbin Institute of Technology at Weihai, China), and Zhengfeng Bai (Harbin Institute of Technology at Weihai, China)
An Fault Diagnostic Method Based on DRN-ACGAN for Data Imbalance
 Instability Fault Knowledge Acquisition and Management of Pumped Storage Unit Based on FTA / FMEA and Ontology Theory
Model Analysis of Engineering Project Process Based on Coxian Distribution
Performance Evaluation of Support Vector Machine for System Level Multi-Fault Diagnosis 113 Rismaya Kumar Mishra (Indian Institute of Technology Delhi, India), Anurag Choudhary (Indian Institute of Technology Delhi, India), Amiya Ranjan Mohanty (Indian Institute of Technology Kharagpur, India), and Shahab Fatima (Indian Institute of Technology Delhi, India)
Gear Tooth Crack Detection using Modal Analysis
Matrix Reconstruction to Estimate Direction of Arrival of Coherent Sources Based on Planar Array 127 Hao Zhang (Hebei University of Technology, China), Dong Zhen (Hebei University of Technology, China), Fang Zeng (Hebei University of Technology, China), Guojin Feng (Hebei University of Technology, China), Zhaozong Meng (Hebei University of Technology, China), and Fengshou Gu (University of Huddersfield, UK)

Remaining Useful Life Prediction of IGBT Module Based on Particle Filter Combining with Particle Swarm Optimization
Maogong Jiang (China Academy of Space Technology, China), Qianqian Lv (China Academy of Space Technology, China), Peilei Li (China Academy of Space Technology, China), Hantian Gu (China Academy of Space Technology, China), Chongyang Gu (China Academy of Space Technology, China), Wei Zhang (China Academy of Space Technology, China), and
Guicui Fu (Beihang University, China)
Research on Anomaly Detection Method Combining Distance Correlation Coefficient and 136 Autoencode 136 Xinhao Shu (National University of Defense Technology, China), Shigang 2hang (National University of Defense Technology, China), Yue Li (National University of Defense Technology, China), Guoji Shen (National University of Defense Technology, China), Guoji Shen (National University of Defense Technology, China), Peiyi Liu (National University of Defense Technology, China), and Gu Ran (National University of Defense Technology, China) Neiyi Liu (National University of Defense Technology, China), and Gu Ran (National University of Defense Technology, China)
Implementation Strategy of Predictive Maintenance in Nuclear Power Plant 143 Rui Han (China Nuclear Power Engineering Co., Ltd., China), Ping Li (China Nuclear Power Engineering Co., Ltd., China), and Ziyu Shi (China Nuclear Power Engineering Co., Ltd., China) (China Nuclear Power Engineering Co., Ltd., China)
Design of Health Management and Intelligent Operation and Maintenance System for Nuclear Power Plant 147 Ziyu Shi (China Nuclear Power Engineering Co., Ltd., China), Ping Li 147 (China Nuclear Power Engineering Co., Ltd., China), and Mengyi Zhao 147 (China Nuclear Power Engineering Co., Ltd., China) 147
A Clustering Mechanism to Identify Close Contact for the Ship Passenger Health
 Underwater GMR Sensor Data Storage using RFID Tags
Intelligent Fault Diagnosis of Bearings Under Variable Working Conditions and Small Samples with Generative Adversarial Network 162 Shushuai Xie (Xi'an Jiaotong University, China), Wei Cheng (Xi'an 162 Jiaotong University, China), Zelin Nie (Xi'an Jiaotong University, China), and Xuefeng Chen (Xi'an Jiaotong University, China)
Defending Against Adversarial Attacks on Time-Series with Selective Classification
Dynamic Model of Planetary Gear with Consideration of Tooth Surface Roughness

Particle Swarm Optimization of Excitation System Design of Magnetic eddy Current Sensor 182 Rukhshinda Wasif (London South Bank University, UK), Mohammad Osman Tokhi (London South Bank University, UK), John Rudlin (TWI Ltd, UK), Ryan Marks (TWI Ltd, UK), Gholamhossein Shirkoohi (London South Bank University, UK), Zhangfang Zhao (London South Bank University, UK), and Fang Duan (London South Bank University, UK)
Research on Fault Diagnosis Technology of UAV Flight Control System Based on Hybrid Diagnosis Engine 188 Mingjie Chen (China Aeronautical Radio Electronics Research Institute, 188 China), Jin Yan (China Aeronautical Radio Electronics Research Institute, 181 Institute, China), Tieying Li (China Aeronautical Radio Electronics Research Institute, China), and Chengzhi Chi (China Aeronautical Radio Electronics Research Institute, China), and Chengzhi Chi (China Aeronautical Radio Electronics Research Institute, China)
Recent Research and Applications in Variational Autoencoders for Industrial Prognosis and Health Management: A Survey
Battery Early End-Of-Life Prediction and Its Uncertainty Assessment with Empirical Mode Decomposition and Particle Filter 204 Jianwen Meng (Ecole Supérieure des Techniques Aéronautiques et de 204 Construction Automobile, France), Meiling Yue (Beijing Jiaotong University, China), and Demba Diallo (Sorbonne Université, France)
A Fault Diagnosis Platform of Actuators on Embedded IoT Microcontrollers
A Diagnosis Scheme of Gearbox Faults Based on Machine Learning and Motor Current Analysis 218 El Yousfi Bilal (Université Jean Monnet de Saint-Etienne, France), Soualhi Abdenour (Université Jean Monnet de Saint-Etienne, France), Medjaher Kamal (Ecole Nationale d'Ingénieurs de Tarbes, France), and Guillet François (Université Jean Monnet de Saint-Etienne, France)
An Intermittent Fault Severity Evaluation Method for Electronic Systems Based on LSTM Network 224 Sheng Li (Jiangxi University of Science and Technology, China), 3 Jiangyun Deng (Jiangxi University of Science and Technology, China), 4 Yuxiao Li (Jiangxi University of Science and Technology, China), 4 Feiyang Xu (Jiangxi University of Science and Technology, China) 4
Modeling and Fault Simulation of Aircraft Lock Mechanism228Sensen Zhu (Northwestern Polytechnical University, China), Zihang Ge(Northwestern Polytechnical University, China), Ting Ma (NorthwesternPolytechnical University, China), Fangyi Wan (NorthwesternPolytechnical University, China), Chunlin Zhang (NorthwesternPolytechnical University, China), Guanghui Liu (Avic Xi'an AircraftIndustry Group Company Ltd., China), and Hao Wei (Avic Xi'an AircraftIndustry Group Company Ltd., China)

Fatigue Life Analysis of Landing Gear Side Strut Based on Finite Element
Using Semantic Dependencies to Realize the Construction of Cloud Data Center Operation and Maintenance Knowledge Graph
State of Power Estimation for Lithium-ion Battery Based on Electrochemical Model and 241 Multiple Restrictions 241 Long Yang (Harbin Institute of Technology, China), Hanqing Yu (Harbin 241 Institute of Technology, China), and Junfu Li (Harbin Institute of 7 Technology, China) 7
 Aircraft Sensor Fault Detection Based on SLD-LMS Algorithm
Monitoring and Mitigating Ionosphere Threats in GNSS Space Environment Science
Circuit Parameter Identification of Degrading DC-DC Converters Based on Physics-Informed Neural Network
Fault Detection for Large Scale Indoor Distributed Antenna System Based on Time Series Similarity 269 Yingqi Wang (Harbin Institute of Technology, China), Shengwei Meng (Harbin Institute of Technology, China), Yuchen Song (Harbin Institute of Technology, China), and Datong Liu (Harbin Institute of Technology, China)
Condition Monitoring of Wind Turbine Main Bearing using SCADA Data and Informed by the Principle of Energy Conservation

Research on Diagnostic Reasoning of Cloud Data Center Based on Bayesian Network and Knowledge Graph
Chao Lou (State Grid Electric Power Research Institute, China), Wang Luo (State Grid Electric Power Research Institute, China), Dequan Gao (State Grid Information & Telecommunication Branch, China), Ziyan Zhao (State Grid Information & Telecommunication Branch, China), Fenggang Lai (State Grid Information & Telecommunication Branch, China), Shengya Han (State Grid Shandong Electric Power Company, China), and Chao Ma (State Grid Shandong Electric Power Company, China)
Fault Diagnosis and Analysis of Automobile CAN Bus Communication289Shanpeng Xia (Weifang Engineering Vocational College, China), WenqiangWang (Weifang Engineering Vocational College, China), and Shengbo Zhou(Weifang Engineering Vocational College, China)
A Method for Refining Oblique Photography Data of Power Transmission Lines
Evaluation of Four Black-box Adversarial Attacks and Some Query-Efficient Improvement Analysis
Rui Wang (Zhejiang University, China)
Human Emotion Recognition Based on Multi-Channel EEG Signals using LSTM Neural Network . 303
Pengyu Lu (University of Electronic Science and Technology of China, China)
Pedestrian Detection for Vehicle-Borne Image Based on Two-Level YOLOv3
Deep Learning with Attention on Hand Gesture Recognition Based on sEMG
Design of Automatic Test Device for Real-Time Axle Temperature Detection System of EMU 321 Huabo Shen (Crrc Qingdao Sifang Co., Ltd., China), Xiaodong Sun (Crrc Qingdao Sifang Co., Ltd., China), Shenghang Xu (Crrc Qingdao Sifang Co., Ltd., China), and Hao Hu (Crrc Qingdao Sifang Co., Ltd., China)
A Classification Application Based on Support Vector Machine for Health IoT
Research on 8-Unit MIMO Antenna of 5G Metal Frame Mobile Terminal

Aero-Engine Performance Evaluation Based on Gas Path Parameters and Operating
Characteristics
(Harbin Institute of Technology at Weihai, China), Keqiang Liu (Harbin
Institute of Technology, China), Shisheng Zhong (Harbin Institute of
Technology, China), Bin Yu (Harbin Institute of Technology at Weihai,
China), and Zhengfeng Bai (Harbin Institute of Technology at Weihai,
China)
CBR-Based Decision Support System for Maintenance Text using NLP for an Aviation Case
Study
Fives CortX, France), Mohammad Ghufran (Fives CortX, France), Safa
Meraghni (Université de Bourgogne Franche-Comté, France), Christophe
Varnier (Université de Bourgogne Franche-Comté, France), Jean-Marc
Nicod (Université de Bourgogne Franche-Comté, France), and Noureddine
Zerhouni (Université de Bourgogne Franche-Comté, France)
Accelerating Deep Reinforcement Learning Under the Guidance of Adaptive Fuzzy Logic Rules 350
Min Wang (China Ship Development and Design Center, China), Xingzhong
Wang (China Ship Development and Design Center, China), Wei Luo (China
Ship Development and Design Center, China), Yixue Huang (China Ship
Development and Design Center, China), and Yuanqiang Yu (Tianjin
University, China)
CNC Machining Quality Prediction using Variational Autoencoder: A Novel Industrial 2 TB
Dataset
Antoine Proteau (École de Technologie Supérieure, Canada), Ryad
Zemouri (Conservatoire National des Arts et Métiers (CNAM), France),
Antoine Tahan (École de Technologie Supérieure, Canada), Marc Thomas
(École de Technologie Supérieure, Canada), Wafa Bounouara (École de
Technologie Supérieure, Canada), and Stéphane Agnard (APN Inc.,
Canada)
Current Sharing Control of Two - Phase Interleaved Parallel Boost Converter Based on Sensorless Current
Huiyun Hou (Shanghai Institute of Technology, China), Jianning Lu
(Shanghai Institute of Technology, China), and Chen Yang (Shanghai
Institute of Technology, China)
Efficient Pavement Distress Detection Based on Attention Fusion and Feature Integration 374
Andong Xie (Zhejiang University, China), Zhi Yu (Zhejiang University,
China), Xiaochun Cao (Zhejiang Scientific Research Institute of
Transport, China), Yangyang Wang (Zhejiang Scientific Research
Institute of Transport, China), and Shoujing Yan (Zhejiang Scientific
Research Institute of Transport, China)
A Data Processing Method of Symbolic Approximation
Yong Zhang (Air Force Engineering University, China), Guangjun He (Air
Force Engineering University, China), Yuanyuan Yu (Air Force
Engineering University, China), and Guanjian Li (Air Force Engineering
University, China)
Detection of Small Objects Based on Feature Fusion
Pan Zhang (Lanzhou University of Technology, China)

Research on Deep Knowledge Tracing Model Integrating Graph Attention Network
A Method of Bearing Fault Feature Pattern Recognition Based on Improved ACGAN
Bidirectional Attention LSTM Networks for Non-Instructive Load Monitoring
An Modified Earth Mover's Distance for Few-Shot Image Classification
Edge Node Information Model Under the Framework of Edge Computing
 Study on IIoT-Based Safety Platform of Industrial Enterprises
Android Mobile Platform Image Processing System Development Based on Fuzzy Logic Enhancement
Research on Neural Network Construction Method Based on Approximate Computational Test
Data 428 Lutao Wang (State Grid Corporation of China, China), Lisha Wu (State 428 Grid Corporation of China, China), Jinlong Hao (Beijing China-Power 1 Information Technology Co., Ltd., China), Zhenyu Chen (State Grid Corporation of China, China), and Cuiling Jia (Beijing China-Power Information Technology Co., Ltd., China) 1 1 Grid Corporation of China, China), and Cuiling Jia (Beijing China-Power 1 Information Technology Co., Ltd., China) 1
Performance Degradation and Life Prediction of Proton Exchange Membrane Fuel Cell
Dynamics Modeling and Optimization for the Tilting System of Unmanned Aerial Vehicles 438 Junqi Lu (National University of Defense Technology, China), Su Cao (National University of Defense Technology, China), Xiangbo Meng (National University of Defense Technology, China), Xiangke Wang (National University of Defense Technology, China), and Huangchao Yu (National University of Defense Technology, China)

Research on Pedestrian Intrusion Detection in Static Scenes	. 444
Xunlei Chen (Chengdu University of Technology, China), Erkang Li	
(Chengdu University of Technology, China), Jian Li (Chengdu University	
of Technology, China), Siqi Yang (Chengdu University of Technology,	
China), Siwen Zhang (Chengdu University of Technology, China), and	
Ziyi Wang (Chengdu University of Technology, China)	
Optimization Design of Anti-Offset Coupling Mechanism for WPT Systems Based on Genetic	
Algorithm	449
Qingsheng Yang (Jiangsu Frontier Electric Technology Co., Ltd.,	
\sim Solution China), Chao Jiang (Jiangsu Frontier Electric Technology Co., Ltd.,	
China), Xinping Wang (Jiangsu Frontier Electric Technology Co., Ltd.,	
China), Chunpeng Li (Jiangsu Frontier Electric Technology Co., Ltd.,	
China), Guofei Guan (Jiangsu Frontier Electric Technology Co., Ltd.,	
China), and Qiqi Luan (Jiangsu Frontier Electric Technology Co., Ltd.,	
China)	
A Multi-Target Tracking and Positioning Technology for UAV Based on Siamrpn Algorithm .	456
Ligang Wu (Anhui Jiyuan Software Co., Ltd., China), Changxin Zhao	•
(State Grid Jiangsu Electric Power Co., Ltd., China), Zushan Ding	
(State Grid Jiangsu Electric Power Co., Ltd., China), Xiao Zhang	
(State Grid Jiangsu Electric Power Co., Ltd., China), Yiding Wang	
(State Grid Jiangsu Electric Power Co., Ltd., China), and Yang Li	
(Hefei University of Technology, China)	
Joint Memory with Distance Recalculation for Unsupervised Person Re-Identification	. 462
Lifeng Zheng (Sun Yat-sen University, China), Yangbin Yu (Sun Yat-sen	
University, China), Haifeng Hu (Sun Yat-sen University, China), and	
Dihu Chen (Sun Yat-sen University, China)	
Detection of Defects on Aluminum Profile Surface Based on Improved YOLO	. 468
Di Wu (Shanghai Institute of Technology, China), Xizhong Shen	
(Shanghai Institute of Technology, China), and Ling Chen (Shanghai	
Institute of Technology, China)	
A Multi-Robot Collaborative Monocular SLAM Based on Semi-Direct Method	. 473
Yun Zhao (Shanghai Institute of Technology, China), Xianghua Ma	
(Shanghai Institute of Technology, China), and Yinzhong Ye (Shanghai	
Urban Construction Vocational College, China)	
Fault Diagnosis of Reactor Based on Vibration Signal Information Entropy	478
Jing Zhang (NARI Group (State Grid Corporation of China), China), Yi	
Jiang (NARI Group (State Grid Corporation of China), China), Qinqing	
Huang (NARI Group (State Grid Corporation of China), China), Haidan	
Lin (State Grid Jilinsheng Electric Power Supply Company, China),	
Tiancheng Zhao (State Grid Jilinsheng Electric Power Supply Company,	
China), and Yongka Qi (NARI Group (State Grid Corporation of China),	
China)	
Intelligent Slurry Level Measurement System of Coal Mine Based on SVM	. 483
Hua Guo (Shandong University of Science and Technology, China),	
Xuejing Zhang (Shandong University of Science and Technology, China),	
Wenya Yang (Shandong University of Science and Technology, China),	
Jinshan Zhuang (Shandong University of Science and Technology, China),	
Mengjuan Zhu (Shandong University of Science and Technology, China),	
Le Kong (Shandong University of Science and Technology, China),	
Qinglin Han (Shandong University of Science and Technology, China),	
and Zhiying Zhang (Shandong University of Science and Technology,	
China)	

From the Air to the Ground: An Experimental Approach to Assess LiPo Batteries for a Second Life
Julio Castro (University of Costa Rica, Costa Rica), Carolina Flores (MINAE, Costa Rica), Diego Gonzalez (University of Costa Rica, Costa Rica), Vanessa Quintero (Universidad Tecnologica de Panamá, Panama), and Aramis Perez (University of Costa Rica, Costa Rica)
Risk Level Estimation for Electronics Boards in Drilling and Measurement Tools Based on the Hidden Markov Model
A Comprehensive Evaluation Method for Aerospace Equipment Fault Diagnosis Capability 501 Jing Zhao (CEPREI, China), Dong Wu (CEPREI, China), Rui Zhang (CEPREI, China), Zhong Shi (CEPREI, China), Chunhui Wang (CEPREI, China), and Tong Li (Xidian University, China)
A Deep Partial Adversarial Transfer Learning Network for Cross-Domain Fault Diagnosis of Machinery
 Fault Diagnosis of Tank Fire Control System Based on NRS and WOA-SVM
Fire Control System Failure Prediction and Health Management Technology
The Survey of Algorithms for Comprehensive Transmission Fault Detection
Research on High Degree-of-Freedom WPT Systems Based on Dipole Coil
Double-Stress Accelerated Degradation Modeling Based on Uncertain Process

Degradation Tendency Prediction for Pumped Storage unit Based on CNN-LSTM ModelN/A Yahui Shan (Wuhan Second Ship Design and Research Institute, China), Hao Wang (Wuhan Second Ship Design and Research Institute, China), Genping Wu (Wuhan Second Ship Design and Research Institute, China), Xing Zhang (Wuhan Second Ship Design and Research Institute, China), and Jiayue Liu (Wuhan Second Ship Design and Research Institute, China)
Degradation State Assessment Modeling using Causality Discovery
Pit Detection in Current Monitoring of Control Rod Drive Mechanism Based on Daubechies Wavelet Analysis
Identification of Soft Faults in Branched Wire Networks by Distributed Reflectometry and Multi-Objective Genetic Algorithm
Construction Method of Multi-Stage Degradation Threshold for Shipborne Helicopter Based on Flight Parameters
Lifespan Prognostics for Lithium-ion Batteries using Long Short Term Memory

Author Index	6	5)	7	'
--------------	---	---	---	---	---