2025 6th International Conference on Mechatronics Technology and Intelligent Manufacturing (ICMTIM 2025)

Nanjing, China
11-13 April 2025

IEEE

IEEE Catalog Number: CFP25FZ3-POD
ISBN: 979-8-3315-2662-7

Copyright © 2025 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.***

IEEE Catalog Number:	CFP25FZ3-POD
ISBN (Print-On-Demand):	979-8-3315-2662-7
ISBN (Online):	979-8-3315-2661-0

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

Table of Contents

Terminal Sliding Mode Control of Electro-Hydrostatic Actuator Based on Disturbance Compensation 1
Bo Zhang, Sanbao Hu

Variable Angle Transmission Ratio Control of Vehicle By-Wire Steering Based on EHA 6
Tiesong Luo, Huiru Guo

Improved Adaptive Sliding ModeSpeed Control For PMSM Drive Based On Improved Sliding Mode Oserver 12
Bo Peng, Jiandong Shen, Qing Sun, Ying Huang

Real-time trajectory tracking control strategy for 3-PRR parallel robot 16
Hongxiang Shen, Bing Li, Xing Luo, Chaoping Ding, Yang Shen, Yulan Wei

Local Path Planning for Mobile Robots Based on Fuzzy Control DWA 20
Ruyi Wang, Jianning Gong, Meng Zhang, Chunping Dai

Sensorless Disturbance Rejection Control Strategy for PMSM Based on SOGI-LTDFO 25
Rencheng Jin, Jianzhang Li, Fan Yang, Ran Zhang

Research on Sensorless Control of Permanent Magnet Synchronous Motors Based on a Gain-Adaptive Sliding Mode Observer 29
Rencheng Jin, Fan Yang, Jianzhang Li, Ran Zhang

A Motor Bearing Fault Diagnosis Method Based on EMD-GAF-RepVGG Framework 34
Yufei Xu, Xinming Liu, Ruiming Zhang, Haichen Li

Research on Dynamic Response and Electrical Collaborative Optimization of Firefighting Water Supply Equipment Based on Intelligent Edge Computing - Breakthrough with Multimodal Perception and Digital Twin Technology 38
Ming Liu, Jian Zou, Yunchuan Wang, Yinqin Zhang

Dynamic Power Reference Adjustment Strategy for Grid-Strengthening Equipment 42
Yujin Li, Shouyuan Wu, Jiahao Liu, Mu Li

State of Charge Estimation of Zinc-Bromine Flow Batteries Using Physics-Informed Long Short-Term Memory Networks 47
Kaiwen Peng, Liguo Wang, Denis Sidorov, Aliona Dreglea

A Study on the Improvement of Inverter Output Voltage Waveform Using Space Voltage Vector Modulation 52
Hongwei Li, Yunhai Hou

Distributed Event-Triggered Control for Current Sharing and Voltage Restoration in Microgrids Under Denial-of-Service Attacks 57
Jian Liu, Shaobin Chen, Wenchao Huang

Research on Electrolytic Copper Rectifier Based on WOA Optimization Fuzzy PID Controller 63
Qing Zhao, Cheng Liu, Yunbo Wu, Linxin Liu

Simulink Modeling and Control Analysis of a Two-Degree-of-Freedom Railway Vehicle System 68
Mingming Yang, Honglin Zhang

Motion characteristics analysis of curved passive adaptive wall-climbing robot 74
Yidong Bai, Aihong Cui, Lingyu Sun, Guoqi Cui

Transmit current overshoot suppression strategy based on HTEM system 79
Fan Tang, Xuhong Wang, Junxia Gao, Ruixiang Gao

Fault Diagnosis of Coal Mine Fan Based on PSO-BP Neural Network 85
Jun Zhang, Yuanhao Shi, Chunjie Chen, Liming Zheng

Orientation Trajectory Smoothing Based on Unit Sphere Projection 92
Weiguang Yu, Daokui Qu, Jin Zhang, Fang Xu, Lei Zhang, Zhenjun Du, Fengshan Zou, Mingmin Liu

Loss optimization method for auxiliary converter circuit of resonant DC link inverter based on SVPWM 99
Jingzhuo Zhang, Yibo Yang, Jiaxiang Song

Trajectory Smoothing Based on Beizer Curve 103
Peidong Wang, Xiping Feng, Yong Li, Saikun Zhang

Research on High-Speed Electric Spindle Thermal Error Modeling Based on Stacking Ensemble Learning Method 107
Ronghao Wang, Jizhen Zhou, Wei Song, Nan Cao, Yindi Cai

Research on Low-Frequency Acoustic Source Localization Based on Bayesian Methods 113
Tianhua Shen, Baohua Li, Yuanjun Dai, Fanglong Zhu

Swing suppression and positioning control of tower cranes based on sliding mode control method 117
Hai Lin, Shilong Zeng

A high-precision and low-latency method for pose estimation based on SAR-Net 121
Hao Ni, Yue Wang

Coordinated Lateral and Longitudinal Stability Control for Six-wheel-independent-motor-drive Electric Semi-Trailer 125
Wenhan Yu, Gangyan Li, Ran Zhao, Guojun Li, Chenghao Wang, Honghui Huang

Precise Positioning Technology for Tunnel Shield Segment Assembly Based on Machine Vision and Neural Networks 130
Guanyang Zhang, Qiang He

Improved Crayfish Optimization Algorithm for Mobile Robot Path Planning Optimization 134
Chao Huang, Zebin Yang

Research on dynamic balance control of CT gantry based on multi-body dynamics algorithm 138
Hao Gui, Yu Fu, Ze Wang, Wei Zong

Research on Multi-objective Path Planning for a Six-Degree-of-freedom Robotic Arm 142
Xinjun Song, Yuxi Wang, Chang Liu, Huralay Erjan, Yinhang Meng, Jin Ran

Design and Torque Analysis of a Lead-Free Piezoelectric Ring-Shaped Traveling Wave Ultrasonic Motor 148
Xiang Shi, Fuyu Zhou, Liang Wu, Qunli An

Research on Workflow Optimization of SCARA Robot Based on Minimum Jerk Ripple-Free Algorithm 153
Tingyu Huang, Lei Zhang, Bingfeng Qian, Zhongwen Zhang

Parameter-Optimized LSTM via DBO Algorithm for Industrial Process Fault Diagnosis 158
Xiang Liu, Jiajia Jiang

Remaining Available Life Prediction Model for Power Electronic Devices Based on Temporal Neural Networks 163
Mingtao Wang, Huanzun Zhang

Three vector predictive control strategy based on parameter recognition 167
Rui Sun, Degang Lv

Improved Model-Free Predictive Control for Permanent Magnet Synchronous Motors 171
Chongyang Chang, Degang Lv

Analysis of vibration in permanent magnet synchronous motors using a new control algorithm 175
Zeyang Zhang, Degang Lv

Low Speed Control Strategy for Sensorless Permanent Magnet Synchronous Motor Drives 179
Yudao Li, Degang Lv

Compensated ADRC control based on permanent magnet synchronous motors 183
Huijie Zhang, Degang Lv

Aerial Landing Trajectory Planning of Sub-mother UAV System Based on PSO Algorithm Considering Aerodynamic Interference 188
Xiaochen Qu, Li Wang, Haolin Chen, Bin Xu

Research on Drive Control of Underwater Oscillating Mechanism Under Complex Disturbances 199
Rui Sun, Long Bai, Zuxing Ma, Yuanxi Sun

Inter-Turn Short-Circuit Fault-Based Thruster Remaining Useful Life Prediction 206
Zhechuan Song, Xiaolu Yang

Stability analysis and simulation of magnetic bearing system integrating fuzzy control and sliding mode control 212
Gang Zhang

Research on PMLSM Speed Control Based on Optimal Preview Repetitive Control 216
Yuxiang Lin, Jian Mao

Vision-Language Fusion Network for Time Series Classification in Machinery Fault Diagnosis 220
Guanxin Wang, Shaoquan Su, Teng Li

Numerical Simulation of Inductively Coupled Plasma Based on Machine Learning 226
Yuxin Liu, Guangqing Xia

Investigation into the Regenerative Braking Control Strategy for Vehicles with Wheel-Side Drive Systems 230
Wenxuan Huang, Sanbao Hu

A Method of Integrating Spatial Division Strategy with Parallelized Boolean Operation to Speed-up Machining Process Simulation 236
Jianing Chang, Erbao Du, Shijin Zhang, Yuqiang Wu, Qian Peng

Optimization of the temperature detection system for the key components of the turbine based on thin-film thermocouples 240
Jiajun Li

Design and Analysis of Soft Bellows Actuators for Multi-Degree-of-Freedom Flexible Motion 244
Fengguang Yan, Wenjing Bao, Shiwei Tian, Zhongjian Wang, Tao Jin, Quan Zhang

A Novel PLC-Controlled Hydraulic Power Device for Enhanced Multifunctional Utilization and Operational Efficiency 250
Zhoubo Wang, Zhen Sun, Hanwen Chen, Jun Zhang, San Yu, Zheng Du

Research on high frequency sine wave pressure generating device 255
Junhao Wei, Jian Zhao, Fengrui Zhao, Honghua Zhao, Menghua Zhang, Dan Wu

Root Cause Analysis and Traceability of Quality Issues in the Assembly Process of Complex Aerospace Products Based on Bayesian Networks 260
Kai Guo, Zhongchuan Ouyang, Guangping Wang, Haoming Rong, Weicai Zhang, Guijiang Duan

Fast Calculation Method for Capacitance of multilayer-structured interdigital electrode capacitor (IDC) 264
Bohan Shao, Guoqing Chen, Zilong Zhou

Design of a 3-degree-of-freedom hip exoskeleton with partial moment sensing capability 269
Hui Dong, Wen Chen, Aiqin Song, Shuqin Wang, Mingxing Lin

Multiobjective Optimization Design of Three-Phase Induction Motor Multilayer Unequal Turns Winding Using NSGA-II 275
Shuai Wang, Meijie Han

Design and Multi-Objective Optimization of High-Power-Density Motors 280
Hong He, Jian Hu, Jianyong Yao

Research on Energy Harvesting and Posture Adjustment Damper System 287
Yaoqi Jin, Xinjian Yuan

P2P Trading Strategy for Active Distribution Networks with Distributed Hydrogen Energy Integration 292
Yuyi Chen

Design Optimization of PMBLDCM for Vibroacoustic Performance Improvement 297
Jun Tian, Wei Cui, Quanfeng Li

Design of an Active Vapor Recovery System and Simulation Analysis of Refueling Characteristics under Refueling Conditions for Plug-in Hybrid Electric Vehicles 301
Enhui Zhang, Junming Zhao, Zeping Wen, Lihe Wang, Jianbin Huang, Fei Xu

Optimization of Vibration and Noise in Permanent Magnet Brushed DC Motors 308
Jun Tian, Yongjun Yao, Quanfeng Li

Design and research of dual full-bridge inverters for electromagnetic transmitters 312
Xiujian Yu, Xuhong Wang, Qinglong Ren, Shanchao Hu

PCFM Complementary Waveform Sets Design Method Towards Reduced Sidelobe Levels 317
Xiangfeng Qiu, Chen Yang, Xinyu Zhang, Weidong Jiang

DINO-DIS: Vision Foundation Model-Guided Feature Disentanglement for Adverse Weather Adaptation 322
Liheng Hu, Jingxuan Jin, De Li

Simulation Modeling of MMC Modules Based on a Semi-Implicit Latency Decoupling Method 327
Yingcong Xiao, Yu Han, Shujun Yao

An efficient simulation approach for voltage source converters based on semi-implicit delay decoupling 332
Yu Han, Yingcong Xiao, Shujun Yao

Investigation of Modular-Stator Flux Modulated Wind Generators With IPM and SPM Rotor Structures 337
Qichao Li, Zecheng Li, Yaojia Huo, Yibo Wang

Study on the flow field characteristics of turbine blades of roof-type wind turbines with different shapes of wind aggregation 341
Fanglong Zhu, Baohua Li, Yuanjun Dai, Wenbin Zhou

A Hybrid Transformer-BiLSTM Model for Lithium-ion Battery Health State Prediction 346
Long Chang, Xiangyu Zhao, Zhihao Yu, Jianchao Li

Study of a Dual-Frequency Up-conversion Piezoelectric Energy Harvester 350
Guoqi Han, Minghui Yao, Zhaoqi Wang

Terrain Traversability Analysis in Uneven Environments 354
Jing Guo, Bingfeng Qian, Jinrun Cheng, Xingwei Dong

Multi-Data Fusion Detection for Lithium Battery Thermal Runaway Based on GRU Neural Network 359
Wenjing Qiao, Shaopeng Li, Qian Zhu, Yonggang Liu

A Novel Stick-slip Piezoelectric Actuator Based on a Bridge-Differential Lever Mechanism 363
Jing Wang, Qi Yu, Jiayu Liu, Xiangyuan Wang, Limin Zhu

Design and dynamic analysis of Hexapod Robots Based on Jansen Linkage Mechanism 370
Ranran Geng, Quanmin Liu, Leihao Jin, Wufan Qian

Electro-thermal coupling simulation and fiber optic temperature measurement of partial discharge thermal effect in XLPE cable joints 382
Jinghui Zhu, Tao Hai, Qian Liu, Faqiang Zhao

Modeling and Analysis of Nonlinear Magnetic Circuit of a Low-Rare-Earth Stator-Magnet Moving-Iron Transverse-Flux Linear Oscillating Motor 388
Xuewei Xie, Xiang Li, Thomas Wu

Design of modular mechanical system for ADCP underwater UAV under turbidity waters 397
Yongcheng Zhao, Kaifeng Xie, Jiayi Xu

Design of Novel CMOS current-mode multi-operand adder Low power encoder design 405
Maoqun Yao, Xiaole Zhang, Yuhan Wang

Vibration analysis of viscoelastic acoustic black hole beams with a new shape function 409
Jun Xu

Numerical Calculation of Complex Flow Field in Regulating Valve and Experimental Study of PIV 415
Haijun Feng, Jia Li, Wanbo Yu, Zhenlai Ma, Xinxin Zhao, Bo Zhang

Paper Explosion-Protected Ex e Motors: A Standards-Compliant Validation Framework Integrating High-Voltage Performance and Industrial Safety 420
Jie Cao, Xiaojing Zhu, Jiangwei Xue, Yang Yang

Analysis of electroosmotic flow in porous media 425
Guiliang Li, Fayu Yao, Jinrong Weng, Daoze Lin

Cable-coupled voltage interference effects on I/O pins 429
Jiangnan Wan, Xuegong Huang

Design and Research of High Mobility Radar Erecting Device 433
Heng Ren, Weidong Kong

Integration of 3D printing technology and UAV navigation system 437
Jinlin Chen, Yuning Chen, Junjie Sun, Xiaoyi Shi, Wangji Liu

Study of Shock Wave and Boundary Layer Interference in Hypersonic Aerodynamics 444
Binsong Zhao

Design and Experimental Validation of a Novel Permanent Magnet Array 450
Bowei Jia, Xinyang Hong, Lu Li, Wei Fang, Daoyi Chen

Research on the Design of a Lumbar Exoskeleton for Load Lifting 457
Yutong Zhai, Xuegong Huang

Development of Crawler Crane Condition Monitoring System Based on Digital Twin 461
Tongxi Zhu, Yulan Wei, Bing Li, Yuncong Gu, Yang Zhang, Zhongjie Shao

Progress of Intelligent Bionic Hand Based on Myoelectric Pattern Recognition 466
Lefan Xu, Weiyu An, Zihao Yang, Yipeng Li, Xinyu Zhu, Xuegong Huang

Rescheduling of Multi-Skilled Workers Based on Improved Sparrow Search Algorithm 472
Chen Guo, Jiamin Liu

Advances and Challenges in Distributed Flexible Manufacturing-shop Scheduling: A Comprehensive Review 476
Haina Qiu, Wenqing Song

Contour Decomposition and Line Segment Feature Recognition of 2D Images Based on Bi-LSTM 481
Yitao Yin, Erbao Du, Shijin Zhang, Ming Chen, Qian Peng

Research on Cutting Control System of Insulation Layer of Insulation Pipe Based on Position Impedance Control 486
Juchen Geng, Yuqiang Cai, Yanfeng Wang

Service Demand Forecasting and Service Composition Optimization Method in Cloud Manufacturing Environment 491
Lihao Wang

Defect detection method of carbon fiber composite conductor based on semi-supervised anomaly detection 495
Junlong Duo, Changlong Yang, Han Bai, Ningning Song, Wei Tong

Design and Application of a Novel Online Jumping Connection Device for Secondary Circuits in Substations 500
Juntang Li, Jiaxuan Yan, Linkun Zhao, Liu Yin, Xia Yang

Accurate extraction method of fault traveling wave head for complex distribution network with distributed power supply 504
Xiangwei Liang, Zhongfeng Pan, Yang Zhao, Hui Wang, Yibo Zhang, Meng Yan

Analysis of vibration characteristics and operation risk of synchronous condenser rotor under dynamic conditions with inter-turn short circuits fault 509
Minghan Ma, Hao Wang, Shaoyong Sun, Tianwei Long

New Methods for Detecting Partial Discharges Using Adaptive Fast Noise Reduction 515
Yimin Song, Xianbin Sun

Application of Resistance Loads in the Testing of Household and Similar Electrical Appliances 522
Huiyun Zhao, Yi Liu, Quan Wang, Yanchun Du, Hongxia Yue, Changshan Chen

Research on improving leapfrog algorithm to optimize transformer fault diagnosis with support vector machine 527
Qian Zhang, Yunhai Hou

A Study on the Location Optimization of Smart Parcel Lockers Based on Bilevel Programming 531
Mengying Wang

Research and Application of Robot 3D Hand-Eye Calibration Method Based on Depth Camera Geometric Constraints 535
Shuaibin Han, Yong Yin

CCDM-UAD: Application of Condition-Controlled Diffusion Models in Unsupervised Industrial Anomaly Detection 540
Tianbao Chen, Jingxuan Jin, De Li

Study on Siting and Capacity Determination of Energy Storage in Distribution Network Based on Improved MOPSO Algorithm 544
Yuchun Sun, Cheng Li

Fire Source Recognition and Localization Algorithm for Tracked Firefighting Robots Based on Integrated Convolutional Neural Networks 549
Nachuan Li, Zhijun Li, Shiqi Liu, Lijia Jiang, Zhigang Li

Research on Anti-Galloping Robot and Mitigation Strategies for High-Voltage Transmission Lines 553
Heyue Zhou, Zheng Liu

Gas Leakage Detection Method Based on YOLOv8 and Optical Flow 558
Yicong Sun, Geng Sun, Xiaodong Li, Zhifang Wang, Shaosheng Fan, Kaiyu Guo

POWERBUS-Based Thermal Runaway Monitoring System Design for Energy Storage Cabin Batteries 563
Qian Zhu, Jianxiang Liu, Wenjing Qiao, Meng Wang

A Study on Fault Diagnosis Method of Chemical Process Based on WOA-LSTM Hybrid Mode 569
Xiang Liu, Jiajia Jiang

Optimization Study of Permanent Magnet Synchronous Motor with External Rotor for Robotic Arm Based on Taguchi's Method 574
Wenchen Li, Ping Huo, Baowang Huang

Intelligent Ship Seakeeping Prediction Using Physics-Informed Neural Networks 578
Lei Sun, Baicheng Zhu, Zihan Qin, Qi Lin, Dazhong Tian

A Multi-Segmented Climbing Robot Integrated with Pressure Sensitive Suction Cup 584
Nanrui Peng, Hangping Tao, Ao Yang

Pose Estimation of Industrial Textureless Objects via Fusion of Simulated and Real RGB-D Data 588
Yu Chen, Fanwu Meng, Wenhao Shu, Jialun Li

ECAIQA: Efficient Cross-Dimensional Attention Network for No-Reference Image Quality Assessment 592
Maocheng Liao, Jian Mao, Haijun Zhou, Di Wu

Manuscript Research on dynamic characteristics of oil churning and torque loss of automatic shift gearbox 596
Yantai Guan, Chen Zheng, Guangxu Wan, Tianrui Niu, Bing Xu, Guoqing Qi

Design of a Digital Twin-Based Shuttle Car Motion Control and Data Monitoring System with API Interface for Underground Coal Mines 600
Zheng Wang, Zhengguang Ma, Yongguo Zhao, Yongfei Xiao, Jia Gao

Lightweight fire detection network based on improved YOLOv8 604
Weikun Ding, Shaopeng Li, Yonggang Liu, Wenjing Qiao

A Road Extraction Method Based on Dual-Domain Feature Fusion and Multi-Stage Fine-Tuned SAM 608
Ming Li, Zhengzhang Yang, Qiang Zhao, Yu Liu

Fault Diagnosis Method for Photovoltaic-Storage Power Stations Based on Multimodal Data Fusion 615
Zheng Peng

A digital twin model of ship block docking 619
Zhengda Jian

Anomaly Detection for Small Hydropower Based on Deep Spatio-Temporal Modeling 624
Yuting Zhan, Bo Yang, Yiping Ma

A Fast Recognition Method of Workpiece Mark Points Based on Machine Vision 631
Yiquan Hao, Jinyu Guo

Tomato Flower Recognition and Localization Based on YOLOv8 636
Bin Pan, Deyi Kong, Huaibei Xie, Xianyuan Xu

A Knowledge-Driven Reconfigurable Modeling Method for Digital Twin Flexible Production Lines 641
Yong Miao, Tingyu Liu, Lei Jiao

Electric Vehicle Battery System Voltage Fault Diagnosis and Analysis Based on Kernel Density Estimation and Z-score 645
Jiaze Li, Yuqian Fan, Xiaojun Tan

Research and Implementation of an Improved Message Scheduling Mechanism Based on Adaptive Genetic Algorithm 649
Hongchao Shao, Guanghe Cheng, Qingyan Ding, Hu Liang, Hu Zhang, Xinxin Wang, Yifei Shao

Raindrop and Film Distribution on Wind Turbine Blades Under Rainfall 655
Wenbin Zhou, Yuanjun Dai, Baohua Li, Fanglong Zhu

Distributed information interaction space station group based on wireless charging 659
Yubo Fang, Qingxu Meng, Zijie Fu, Zengqi Wang, Chenxu Liu

Author Index 663