

# **2022 5th World Conference on Mechanical Engineering and Intelligent Manufacturing (WCMEIM 2022)**

**Ma'anshan, China  
18-20 November 2022**

**Pages 1-609**



**IEEE Catalog Number: CFP22V71-POD  
ISBN: 978-1-6654-7370-5**

**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.***

IEEE Catalog Number:	CFP22V71-POD
ISBN (Print-On-Demand):	978-1-6654-7370-5
ISBN (Online):	978-1-6654-7369-9

**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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## Table of Contents

<b>Design of Automatic Loading Mechanism Based on PLC Control</b>	1
Zhuolin Wang	
<b>Design and Simulation of the Picking Roll of the Corn Harvester</b>	6
Mingpeng Zhao, Shuguang Sang, Mingqing Wu, Changzhong Wu	
<b>Design and Analysis of Paver Walking Hydraulic System Based on AMESim</b>	10
Heng Wang, Mingming Shang, Yicheng Xu, Chao Zhang, Shiyi Wang, Shenyu Yang	
<b>Design and analysis of a novel soft actuator with high contraction ratio based on nested structure</b>	15
Qing Zhu, Yitian Li, Qingyun Liu, Mengqian Tian	
<b>Study on High Density Blind Mating Design of a Radar Antenna</b>	19
Zhaobin Hong, Kai Zhao, Zhijian Zhou, Xuhong Wang	
<b>Half-physical Simulation System Design of Chamfering Device Based on PLC</b>	23
Yunhao Fu, Qingzhu Zhang, Hongtao Han, Qiang Zhang, Liangyou Li, Bing Li	
<b>Design of printing enterprise data statistics management system based on B/S structure</b>	27
Haodong Ding, Yongbin Zhang, Xiuli Fu, Yuansheng Qi	
<b>Design and implementation of super BOM based on dynamic library table</b>	31
Fan Fan, Hairong Yan	
<b>Structural Design of a Cable Climbing Robot</b>	36
Yongming Wang, Xiang Li, Feng Yin	
<b>Influence mechanism of Valve opening on flow field stability of bypass valve of conventional island Steam Turbine</b>	41
Wenze Yang, Xuan Jiang, Kunming Cheng, Jin Li, Yitao Huang, Lei Zhang, Hongtai Zhang, Jun Zhou, Wei Yuan	
<b>Design and Verification of Thermal Balance System for Electric Drive Transmission in Urban Public Transit</b>	50
Lu Ao, Qiang Zhang, Zhaoxiang Dong, Bing Li	
<b>Design of MPM Based Information Structures of PLM</b>	54
<b>System for Aerospace Mechatronic Servo System</b>	
Enming Song, Yan Ma, Shixin Kan, Dongming Zhao	
<b>Design and Development of a Numerical Control System for a Hybrid Machining Robot</b>	60
Zaichao Sun, Hanliang Fang, Chaosheng Chou, Fufu Yang, Jun Zhang	
<b>Design and Numerical Simulation of Vibration Isolation and Shock Resistance for the Electronic Equipment on the Rockets</b>	66
Jianzhao Lu	
<b>Finite element analysis of lift speed limiter rope sheave material based on Ansys computer simulation technology</b>	71
Xingyan Li, Yongbin Zhang, Xiuli Fu, Yuansheng Qi	
<b>Design of Referee System for Competition Based on Wireless Sensors Networks</b>	75
Zhaoxiang Dong, Yulan Wei, Siqu Li, Zhongjie Shao, Haifeng Xu, Qingzhu Zhang	
<b>Simulation and Experiment Research on Performance of High Power While-drilling Turbine Generator</b>	79
Fei Li, Lihao Cheng, Hao Wu, Wenxuan Zhao	

<b>Design of Direct ACC Unit Temperature Detection System Based on Energy-Harvesting Wireless Sensor Node</b>	83
Gengbai Li	
<b>Scheme Design and Verification of Heavy-duty Universal Launch Base under Strong Constraints</b>	87
Binglun Hu, Xueming Peng, Maohua Qu, Chong Li	
<b>Design of sensor array data acquisition system based on equipotential method</b>	93
Xinya Zhang, Yu Xie, Renpeng Wang, Jiangtao Xiao	
<b>Numerical simulation of influencing factors on corn Silage machine throwing effect based on EDEM</b>	97
Hongbin Wang, Shukun Cao, Guo Zhao, Chong Cao	
<b>Simulation and experimental verification of the elevator pre-trigger stopping system</b>	101
Xiaoqing Chang	
<b>Finite Element Analysis of Surface Ship Hull Thin Section Lifting Scheme</b>	105
Hao Ge, Shenglei Yang	
<b>Real-time mechanical performance analysis of pusher structure of packaging machine based on digital twin system</b>	111
Tianqiang He, Nanyan Shen, Jiquan Shen, Jianjun Wu, Jing Li, Haoyang Li, Jiawei Mao	
<b>Development of Pipe Bending Machine Detection System Software Based on C++ and Java</b>	117
Ting Wang, Yulan Wei, Siqi Li, Hongtao Han, Lianghong Li, Bing Li	
<b>Simulation analysis of printing pressure</b>	122
Kun Chang, Jialin Li, Shuqin Wu, Yiming Wang	
<b>Observability Keeping in Observer Design of Descriptor System and Its Form</b>	128
Wenzhong Liu, Lu Wang, Shenghui Guo, Darong Huang	
<b>Design and Implementation of a Group of Cooperative Robots</b>	134
Chunxian Chen, Zhaopeng Qiu	
<b>Design of Compound Logistics Robot Based on STM32</b>	139
Yunjian Chen, Zhengwu Mao, Bowen Hu, Dazhang You, Zhengbo He	
<b>Study on the Characteristics of Multiway Valve with Compensator with Variable Pressure Difference</b>	145
Xinyuan Chen, Bang Li	
<b>Objective parameter balance control and optimization design of sound quality of rolling rotor compressor</b>	151
Junyu Li, Qibai Huang	
<b>Research on electric vehicle DC speed regulation based on PSO optimization</b>	156
Linya Qin, Xinyi Wang, Yuyang Wang	
<b>The refactoring method about 3D model's horizontal profile for Additive manufacturing</b>	164
Chunlin Tian, Lirong Liu, Jinzhe Li, Guilin Zhang	
<b>Development of a New Testing System for Reliability Assessment of Hydraulic Cylinder</b>	169
Wenlin Wang, Kai Yan	
<b>Design of a cut tobacco volume flow detection system based on bulkscan lms511</b>	173
Shaolong Han, Jianlin Zhang, Lei Liu, Zhenyu Yang, Baoxin Ran	

<b>Order priority decision of manufacturing enterprises: an improved Delphi-AHP-TOPSIS methodology</b>	178
Yuanhao Hu, Lei Xu, Junbai Zhong, Han Gao, Zongliang Mou	
<b>Numerical simulation of a high specific speed centrifugal pump</b>	188
Guisheng Yu, Chuan Wang, Qiqi Zhang	
<b>Design and manufacture of small off-road racing car for national Baja auto race</b>	192
Kong Peng, Yin Hai, Zhou Heng	
<b>Design and Production of University Students' All terrain Two Drive Baja Racing</b>	199
Kong Peng, Cao Hua, Zhou Heng	
<b>Research on Lubrication and Lubricating Oil Supply Strategy of Low-speed Diesel Engine Cylinder-Piston Ring Pack</b>	206
Jiyun Zhang, Jinhua Liu, Zhixiang Pan	
<b>An End-Edge-Cloud Based Method of Business Data Sign and Collaborative Processing for the EMU Bogie</b>	214
Yong Sheng, Geng Zhang, Yingfeng Zhang	
<b>Study on the performance of shell and tube heat exchanger under different shell flow patterns</b>	220
Yicheng Xu, Mingming Shang, Heng Wang, Chao Zhang, Shiyi Wang	
<b>Research on Low Frequency Vibration Reduction of Transformers Based on Particle Damping</b>	224
Bing Luo, Yongsheng Xu, Gangyi Xu, Qibin Liu, Wangqiang Xiao	
<b>Smoke Gas Leakage Calculation and Data Analysis of Lift Landing Door Fire Resistance Test</b>	230
Shuai Kong, Zheng Lin, Chao Li, Ping Tang, Yinde Jin	
<b>Random Vibration Fatigue Analysis and Structure Optimization of an Airborne Power Supply Unit</b>	234
Jingkai Wu, Pengfei Yan, Ningxiang Lu, Binghui Liu	
<b>Multi-objective production scheduling method for decommissioned power battery dismantling workshop based on segmental strategy</b>	240
Peigen Tian, Xiao Xi, Zhang Yi	
<b>Broadband Sound Insulation Performance of Composite Double Sandwich Panels with Periodic Piezoelectric Arrays</b>	247
Di Xu, Qibai Huang	
<b>Fluid Simulation of Trajectory Stabilization System for High Speed Aircraft</b>	252
Ruihang Zu, Libin Tan	
<b>The Frame Response Time Interval Based Device Fingerprinting Identification</b>	261
Jing Guo, Yajuan Guo, Haitao Jiang, Fan Wu, Ziyang Wang, Zhimin Gu	
<b>Study on acoustic emission signal of diamond grinding roller binder</b>	265
Qingbin Wang, Honghui He, Huadong Zhao, Zhenwei Zhu, Chang Liu, Shuaikang Zhou	
<b>Research Progress of Electrical Discharge and Electrochemical Hybrid Machining Technology</b>	269
Weixin Gong, Hang Dong, Jianping Zhou, Yu Qiu, Changke Chen, Pengfei You	
<b>A method for obtaining user requirements based on NLTK and knowledge graph</b>	276
Zhanfei Wang, Libin Tan, Xiaoliu Yu	

<b>Research on Structure Optimization and Internal flow of Cyclone in Catalytic Cracking Device</b>	281
Wanlin Wang	
<b>Simulation Analysis and Experimental Research on Differential Pressure Flow between Venturi and Orifice</b>	287
Bai Zhang, Hongxin Zhang, Xinyang Han, Zheng Gao, Jiajia Sun, Dongliang Wei	
<b>Calibration Method for Simulation Model Parameters Based on Physical and Simulation Test Data</b>	298
Haiyang Ma, Xiaobo Zhou, Yu Hong, Ning Yang	
<b>Research on the Reliability Improvement Technology of Important Auxiliary Machines of Thermal Power Units Based on Deep Peaking</b>	304
Shuai Di	
<b>A Part Manufacturing Process Knowledge Recommendation Method Based on Hybrid Model</b>	308
Hongpeng Zhang, Zhenjun Ming, Ruiqiang Lv, Tingting Du, Hu Lu, Qiang Li	
<b>Design and Optimization of a Kangaroo-inspired Jumping Robot</b>	314
Bin Liu, Wenjie Ge, Yuzhu Li, Dianbiao Dong	
<b>The Structure Stiffness Optimization Design And Test of a Satellite</b>	319
Xin Xu, Zhijia Liu, Yongqiang Hu, Meijie Lv, Jiang Liu, Sihan Shi	
<b>The Liquid Rocket Engine Experiment Data Quality Improvement Based on 3<math>\sigma</math>-LMBP</b>	326
Yichen Zhong, Jingwen Fan, Jie Chen, Zhujun Ren, Zijun Liu	
<b>Tolerance analysis and allocation of precision rotary table based on Jacobian-Torsor statistical model</b>	330
Wei Mo, Xueming Du, Shun Liu, Sun Jin	
<b>Degradation Prediction of Li-ion Batteries based on Linear Mixed Effects Model with Mixtrure Prior</b>	335
Jinzhong Li, Lei Mao, Zhiyong Hu, Jiarui Zhang, Yuguang Xie	
<b>Automatic Door Control System of Ceramic Pipe Fitting Production Line Based on PLC</b>	341
Hengshuai Guo, Changzhong Wu, Xiaoyong Li, Guitao Wang	
<b>Design on wire cutting process of micro gear based on Opticam</b>	345
Ruishen Chen, Xianghui Zhan	
<b>Application of Grey Markov Prediction Model in Airline EDP Maintenance Requirement Decision</b>	349
Xin Liu, Danyang Shen	
<b>Simulation of thin-walled cylindrical parts assembly under ship oscillation</b>	355
Kehui Xu, Kairui Xue, Shixun Fan, Zhijie Wen, Dapeng Fan	
<b>Research on the Optimization of Production Line Based on the Value Stream Analysis</b>	359
Suli Feng, Zhongmin Li, Yaing Li	
<b>Parametric Design and Performance Analysis of Drive Axle Housings Based on Secondary Development of UG NX</b>	364
Yunping Pan, Jianhang Liu, Changquan Wu, Lieping Liao	

<b>Research of high-efficiency extraction of edges of large complex components in three-dimensional point clouds</b>	370
Jing Li, Jiangchuan Fan, Nanyan Shen, Hui Qian	
<b>A Structural Optimization Method for Constant and Variable Stiffness Composite Laminates</b>	374
Yuzhu Li, Wenjie Ge, Bin Liu, Dianbiao Dong	
<b>Digital Precision Assembly Technology of Piston Accumulator Sealing Pair</b>	383
Enming Song, Yizhou Hu, Yong Ding, Ning Wang	
<b>Morphological Construction of Transmission Error of Precision Reducer Based on BP Neural Network</b>	390
Zhiyong Yu, Zhaoyao Shi, Huijun Yue, Lintao Zhang	
<b>The Acoustic Pressure Enhancement of Piezoelectric Micro-machined Ultrasonic Transducer</b>	396
Lizhou Yang, Fengqi Yu, Benxian Peng	
<b>Design Optimization and Simulation Analysis of Screw Extrusion 3D Printing Screw</b>	400
Shiying Zhang, Guofeng Xia, Xiangyang Hao, Yi Zhang, Wei Chen, Zhongyuan Zhou	
<b>Optimizing of vertical lathe sliding pillow based on TRIZ/DOE</b>	405
Shang Liu, Xiaoxia Guo, Yulong Xu, Meng Lv, Han Wu	
<b>Extraction of key geometric errors of a precision cylindrical grinder based on improved Sobol method</b>	410
Jihui Han, Liping Wang, Pengxiang Zhang, Haitao Du, Dong Wang, Xuekun Li	
<b>Target cascading optimization for flexible distributed shop scheduling problems with multi-objectives</b>	416
Yingjie Huang	
<b>Structural Topology Optimization of An Aero Vehicle's Magnesium Alloy Bottom Cover</b>	423
Yang Hong, Xiaojun Zhu, Lei Li, Yuan Chang, Qingming Ge	
<b>Intelligent car production based on single-chip microcomputer</b>	428
Xiao Xiao, Zuxu Zou, Qian Deng	
<b>Optical encryption of gray image based on CS and CGH with double chaotic system</b>	432
Xueyan Zhao, Zhao Zhang, Shuqi Niu, Xintong Tian	
<b>Study of Flow Field Characteristics under Simultaneous Regulation of Dual Valve Sets for Conventional Island Condensate</b>	436
Shuxia Zhang, Shouxia Zhao, Zhen Zhang, Xianling Liu, Tao Yu, Simeng Zuo, Wei Yuan, Hongtai Zhang, Jun Zhou, Lei Zhang	
<b>Helmet Wearing Detection Using Improved Single Shot Multibox Detector</b>	444
Haobo Feng, Jiwei Hu	
<b>Research on "Digital Quality Control" Method in Spacecraft Development Process</b>	448
Jingjing Zhao, Yuxue Qiu, Chang Liu	
<b>Research on Bearing Fault Diagnosis Based on ResNet-BLSTM-SVM</b>	452
Zhiqiang Liu, Xiukun Wei	
<b>Beidou+PS-InSAR Technology for Substation Geological Subsidence Monitoring and Early Warning Research</b>	456
Shuo Wang, Ruihua Chen, Zhiming Huang, Hang Jing, Xisen Wang	

<b>Research on Young's Modulus Prediction Model of Particle Reinforced Composites</b>	462
Tao Jiang, Tiewu Zhu, Zhilong Chen, Haipeng Hou, Minglei Jin, Liming Wang	
<b>Multimodal Disinformation Detection with Joint Propagation Structure</b>	467
Shenwu Zhang, Xinyang Ding, Weiguang Liu, Hailong Zhao	
<b>Improving the Performance of Fast Steering Mirror Based on Kalman Filter and Fuzzy PI Control</b>	472
Dingqian Tan, Qinyong Zeng, Dazhong Wang, Chenlong Liang	
<b>Method and System of Visibility Analysis Based on Human Eye Imaging Process</b>	476
Gang Chen, Chuan Chen, Qiang Ren	
<b>Control and Visualization of 3D Pipe Model Based on OpenGL</b>	484
Hongtao Han, Bing Li, Yunhao Fu, Ting Wang, Liang Zhang, Yulan Wei	
<b>Arc-Fault Detection using One-Dimension Convolution Neural Network</b>	488
Zibo Qi, Xin Qi, Wei Gao, Wu Ying	
<b>Three-dimensional recognition method of fruit target based on PointNet++</b>	496
Xiangxiang Wu, Libin Tan, Xiangrong Xu	
<b>Deep Fault Diagnosis of Marine Diesel Generator Sets based on Multi-level Decision Fusion Model</b>	501
Shuai Yu, Feng Leng, Wei Xie, Yongmao Wang	
<b>Research on quality defect analysis and prediction model based on association rule mining</b>	505
Xianlin Ren, Chengrui Han, Yiduo Tian, Laixian Chen, Bao Liu	
<b>Path Planning and Tracking Control Method Based on Bessel Curve</b>	511
Zhiben Zhang, Changsheng Ai, Song Li, Yifei Xue, Gangchang Ren, Qian Zhang	
<b>Early fault diagnosis method based on time-domain marginal spectrum of S transform and SVM for rolling bearings</b>	515
Yunqiang Zhang, Huaiguang Wang, Dinghai Wu, Xiaolei Li	
<b>A Self Developed Cooperative Manipulator and Its Zero Force Drag Control</b>	521
Chenglin Lei, Shansheng Huang, Zebang Zhong, Jiazhen He	
<b>A Reinforcement Learning Method for Inventory Control Under State-based Stochastic Demand</b>	527
Hao Yin, Qingwei Jiang, Junxiang Ruan, Canrong Zhang	
<b>Research on Actively Supported Accurate Sensing Control Technology for Primary Frequency Regulation of Wind Farms</b>	533
Shuai Di	
<b>Research on manufacturing quality control method based on the probabilistic intuitionistic fuzzy set prediction model and the triple exponentially weighted moving average control chart</b>	537
Xianlin Ren, Chengrui Han, Yiduo Tian, Laixian Chen, Bao Liu	
<b>Selection of Heat Dissipation Devices for Photovoltaic Power Generation Module based on Cluster Analysis</b>	543
Dan Peng, Zhanpeng Xu, Peijian Xu	
<b>Reliability optimization for load-sharing systems with exponentially distributed units</b>	547
Yuhan Qin, Kun Wang, Songhua Hao	



<b>Aerodynamic drag estimation of ultra-low orbit spacecraft</b>	552
Zhenwei Feng, Yongqiang Hu	
<b>Cassini Oval Scanning for High-Speed AFM Imaging</b>	556
Yu Liao, Xianmin Zhang, Longhuan Yu, Jianhao Lai, Benliang Zhu, Hai Li, Zhuobo Yang, Chaoyu Cui, Ke Feng	
<b>Bearing Fault Detection Method Based on GA-Xgboost Machine Learning Algorithm</b>	560
Zhaoji Li, Zijie Ji	
<b>Fault diagnosis of electro-hydraulic servo valve based on multilayer perceptron</b>	564
Erchuan Su, Xiaojun Guo	
<b>On machine detection of tool breakage based on machine vision</b>	569
Jiabao Yang, Xi Zhang, Jingyu Tian, Wenniu Zheng	
<b>State of Health Monitoring and Remaining Useful Life Prediction of Lithium-Ion Batteries Based on Integrated Model</b>	574
Jun Zhang, Zhehui Wang, Chuang Sun, Qiyang Shi, Zhenhong Jia	
<b>Step Motor Control Based on PLC</b>	579
Shilong Lv, Zenghui Liu	
<b>Maintenance Importance Model of CNC Machine Tools Based on Natvig Importance</b>	583
Xiaofeng Wang, Liudi Wang, Shiru Guo	
<b>Principle and common fault analysis of hydraulic system of YT4543 power sliding table</b>	588
Hong Wen	
<b>Multi-channel LSTM-CNN power load multi-step prediction based on feature fusion</b>	591
Feiying Li, Jinfeng Xiao	
<b>Human-robot collaboration re-manufacturing for uncertain disassembly in retired battery recycling</b>	595
Hao Yin, Jinhua Xiao, Guoxian Wang	
<b>Vibration-based high voltage shunt reactor fault diagnosis with Incep-DenseNet</b>	599
Changwei Zhao, Zhongyong Liu, Yucheng Qian, Lei Mao	
<b>Safety Monitoring of Mooring Bollard Structure Based on Optical Fiber Sensing Technology</b>	604
Pin Ye, Weili Wu, Guoping Ding, Jianxin Li, Zhiqiang Li	
<b>A New Image-Based Temperature Prediction Method</b>	610
Hongyuan Jiao, Chuan Ma	
<b>The quality inspection of railway vehicle gearbox based on Q-switched wavelet sparse decomposition</b>	614
Zhongjie Shen, Pan Li, Zitong Li, Baogui Gong	
<b>Collaborative robotic arm-based arc additive manufacturing system and part forming control study</b>	620
Yongkang Liu, Quancheng Dong, Xuan Sun, Lianfa Tian, Fuxin Du, Baizhen Li	
<b>Model-Free Predictive Current Control of Virtual Infinite Capacitors</b>	624
Wei Liu	
<b>Research on the economic-statistical model of VSI control chart based on multiple mass variation factors</b>	628
Xianlin Ren, Yiduo Tian, Chengrui Han, Laixian Chen, Bao Liu	

<b>Demagnetization Fault Detection Research of Brushless DC Motor Based on Machine Learning</b>	634
Le Han, Xin Fu, Songpo Tian, Zhonghong Shen	
<b>Estimation of near-surface NO<sub>2</sub> based on TROPOMI and provincial control stations' data using machine learning</b>	639
Fuliang Deng, Yijian Chen, Lanhui Li, Cong Wang, Luwei Cao, Chaofeng Peng	
<b>Detection Method of Ore Particle Size Distribution Based on YOLOv5</b>	645
Niu Niu, Yongming Wang, Libin Tan	
<b>On-line comprehensive measurement method and system for taper thread of pipe in non - contact</b>	650
Yanyu Chen, Dongzhuang Tian, Mengmeng Dong, Chun Zhou, Hongjie Tian	
<b>A Fault Diagnosis Method for High-speed Train Wheelset Bearings Based on Deep Learning</b>	656
Hu Zheng, Libin Tan, Xiaoliu Yu	
<b>A Closed Loop Quality Control System Based on Online Measurement Technology for Aviation Complex Component Manufacturing</b>	661
Kaiyang Chu, Rui Liu, Guijiang Duan, Mingyu Zhang, Xinhe Qu	
<b>Shoveling Trajectory Tracking Control of Loader Working Mechanism</b>	668
Guodong Liang, Li Liu, Yu Meng, Guoxing Bai	
<b>Fault Diagnosis and Maintenance Techniques for Hydraulic System of Common Construction Machinery</b>	674
Hong Wen	
<b>Construction and application of digital twin model for tool wear monitoring and life prediction</b>	678
Chao Liang, Wenan Mo, Jing Tang, Ji Wang, Chuangmian Huang, Gaoyi Luo	
<b>Hydraulic System Principle and Common Fault Analysis of Hydraulic Press</b>	685
Hong Wen	
<b>An Improving NARX Multi-step Prediction Model for Ship Lifting and Sinking Motion</b>	689
Rui Ji, Chulin Yang, Zhen Su, Yongmin Zhou	
<b>Polar Environment Monitoring Buoy Based on MSP430 MCU</b>	696
Feng Zhang, Musheng Lan, Yinke Dou, Jianfeng He, Zhirui Xing	
<b>Testability D Matrix Generation Method Based on Transitive Closure</b>	701
Xiaoshuai Du, Bing Hu	
<b>Computer Simulation of Axle Hub Structure Optimization of a Heavy Vehicle</b>	706
Hongzhuang Zhang, Suli Feng, Zhongmin Li	
<b>A method for assembly sequence planning considering geometric priority relationship and aggregation</b>	710
Lianxi Liu, Xuetao Bai, Yongfeng Hou, Weibo Li	
<b>Design of Crawler Crane Simulation System Based on Digital Twin</b>	716
Zhongjie Shao, Bing Li, Zhaoxiang Dong, Haonan Ye, Jianguo Liao, Yulan Wei	
<b>Design and Research of Digital Twin System for Hybrid Robot</b>	720
Zehui Ma, Jing Li, Nanyan Shen, Jun Zhao, Hao Wang	
<b>Automatic generation and detection method of LCD samples based on deep learning</b>	724
Jiayuan Liu, Hao Wu, Yulong Liu, Junchao Wang	

<b>Key Technology of Multi-arc Parallel Additive Manufacturing Equipment Control System</b>	731
<b>Research on realizing multi-arc cooperative communication and HCI</b>	
Jingxuan Nie, Junjin Huang, Jiping Lu, Changmeng Liu	
<b>Review of Triboelectric Nanogenerators Applied to the Field of Intelligent Robotics</b>	736
Yutong Wang, Qing Zhu, Zhiyuan Zhu	
<b>Design and experiment of a novel manipulator for autonomous harvesting tomato clusters</b>	740
Jinliang Yin, Ting Yuan, Jiacheng Rong, Yan Yang	
<b>Research on the frame of formation of multi-USV</b>	746
Yan Li, Jianqiang Zhang, Yi Li, Haoxuan Wang	
<b>Adaptive controller for synchronous motion control of hydraulic vibration hammer</b>	750
Yajun Liu, Nengchang Guo, Yizhuo Zhao, Kun Yu, Linfeng Quan	
<b>Research on the Outer Wall Grinding Robot for Spherical Tanks Based on High-Pressure Waterjet</b>	756
Xingji Du, Shuai Kong, Ping Tang, Chenfeng Guan, Weican Guo	
<b>Force/Position Control of Heterogeneous Teleoperation System Based on Adaptive Fuzzy&amp; CMAC NN</b>	761
Zelin Sun	
<b>Simultaneous localization and mapping for tethered robot based on UFastSLAM</b>	769
Xiaotao Wang, Huarui Liu, Yuxin Cui	
<b>Design of WMS for Digital Flexible Production Line of Aerospace Mechatronic Servo System</b>	774
Enming Song, Zhenkun Song, Qiaochu Guo, Baobin Hu	
<b>Development of PSA Tube Bundle Nitrogen Generating Modules with High-pressure and High-purity on Offshore Platforms</b>	780
Jixiang Yue	
<b>Match analysis of green manufacturing based on cloud platform</b>	785
Wentao Gao, Jianfeng Lu, Hao Zhang, Tiaojuan Han	
<b>Research on application of automation technology based on mechanical manufacturing industry</b>	790
Mei Zhang	
<b>Development of a power line Inspection Robot Capable of automatically crossing Obstacles</b>	795
Xiang Yue, Yanhua Liu, Hongguang Wang, Yan Feng	
<b>Design and Research of 5 DOF Material Handling Robot</b>	800
Zhuangchao Zhan, Xingguo Han	
<b>Target Tracking Method for Visual Autonomous Localization of Demolition Robot</b>	806
Yimo Zong, Jianzhong Huang, Jiahan Bao, Deshang Sun, Yuwan Cen	
<b>Multistage Fusion Approach of Lidar and Camera for Vehicle-Infrastructure Cooperative Object Detection</b>	811
Hang Yu, Yongsheng Zhao, Ying Zou, Qian Li, Haiyang Yu, Yilong Ren	
<b>Autonomous generation method of robotic grinding program for large model-free complex forgings</b>	817
Pengfei Su, Qilong Wang, Shouxin Yan, Wei Wang, Yuanle Wang, Xiaotian Gao	

<b>Fish Detection Based on Halcon and MobileNetV2 for Automatic Fish Feeding System</b>	821
Fengyuan Jia	
<b>Vision-driven High Precision Positioning Method for Bracket Assembly with Industrial Robot</b>	825
Chengyuan Li, Qingzhen Bi	
<b>Rapid Positioning Method of Civil Aircraft Assembly Scene Based on Vision</b>	831
Shaojie Sheng, Qijie Zhao	
<b>FAST handling robot stiffness analysis based on finite element simulation</b>	835
Yong Zhou, Ligang Qiang, Yong Zhang	
<b>Development of an Experimental Platform for 3-DOF Planar Parallel Robots</b>	840
Huadong Wu, Yulan Wei, Xinze Lian, Xing Luo, Chunyan Peng, Bing Li	
<b>SLAM for Firefighting Robots: A Review of Potential Solutions to Environmental Issues</b>	844
Yiwei Hong	
<b>Path Planning for Service Robots</b>	850
Ruining Li	
<b>A Smooth and Time-Optimal Trajectory Planning Approach for Automated Systems</b>	854
Xinda Wang, Huijuan Chang, Jian Zhang, Xiangxi Sun	
<b>Adaptive Control for a Second-order Chaotic System with Unknown Nonsymmetric Actuator Dead-Zone</b>	859
Xintong Tian, Zhao Zhang, Shuqi Niu, Xueyan Zhao	
<b>Efficient skeleton-based Human Assembly Action Recognition Optimized by Data Augmentation</b>	864
Yaqian Zhang, Jizhuang Hui, Tao Zhou, Kaiyang Zhang, Kai Ding, Weiwei Wang	
<b>Toward Kinematic Control for Redundant Manipulators with Flexibility Optimization</b>	868
Xin Su, Xin Chen, Xiaojing Lv	
<b>The Research of Droppable Ballast Device of Manned Submersible based on Computer-aided Ergonomics design</b>	872
Yugang Ren, Hanbin Zhang, Xianpeng Shi	
<b>Research on 3D LiDAR Point Cloud Matching Localization Method</b>	878
Yifei Xue, Changsheng Ai, Li Song, Lijun Qian, Gangchang Ren, Lujun Zhai	
<b>Distributed Optical Fiber Sensing Signal Recognition Based on Deep Residual Shrinkage Network</b>	882
Huikang Liang, Haoshen Xie, Hongbin Huang, Ximing Li, Weiping Liu	
<b>Research on key technologies of random stacking components automatically crawl</b>	887
Hancheng Yu, Yanjun Jing, Xihao Zhu, Seqi Jiang	
<b>Application of FMECA in Vehicle Reliability Analysis Based on Fuzzy Evaluation Method</b>	894
Yaping Li, Yixiang Wang, Peng Jiang	
<b>A mobile robot repositioning method combining vision and laser</b>	898
Yi Zhang, Yuanpei Gao, Jinyan Li, Dongjie Jiang	
<b>Simulation Analysis of Electromagnetic Output Force of Linear Motor with Single Magnetic Steel or Dual Magnetic Steel</b>	904
Yukun Zhou, Hailing Qiu	

<b>Research on monitoring and early warning of substation geological subsidence based on high-precision Beidou positioning</b>	908
Zixin Li, Shuo Wang, Haomiao Xin, Zhuwei Liang, Zhi Li	
<b>Design and Implementation of an Autonomous Line Patrol and Obstacle Distribution Robot</b>	913
Chunxian Chen, Zhaopeng Qiu	
<b>Studies on Calibration of Shaking Incubator</b>	917
Huijuan Wang, Tingting Ren, Yang Xu, Chuandong Xie, Yingqian Ni	
<b>High-speed automatic biochemical immune assembly line</b>	923
W J Fan, M X Lin, M Y Zhao, Q H Xie, B Wang	
<b>Weld Seam Identification and Calibration Method of Spiral Steel Pipe Grinding Robot</b>	927
Ao Cao, Yaguang Zhu, Yangyang Liu, Qiong Liu, Xu He	
<b>WiFi-PDR indoor fusion positioning based on EKF</b>	933
Xiaobing Wang, Tongyue Gao, Jinwang Li, Weiping Guo, Daizhuang Bai	
<b>Research on workshop manufacturing resource location method based on industrial Internet of things</b>	938
Limin Jia, Ru He	
<b>Fully Automatic Double-arm Intelligent Crane</b>	942
Ruiwu Liu, Ze Zhu	
<b>Research on Multi-Objective Resource-constrained Project Scheduling Problem Based on Improved NSGA-II Algorithm</b>	947
Zuojia Yuan, Yaqi Zhang, Fuwang Li, Cunrong Li	
<b>Research on Network-Source Cooperative Intelligent Frequency Regulation Technology for Thermal Power Generating Units</b>	952
Shuai Di	
<b>Intelligent Operation and Maintenance System of Grain Combine Harvester Based on STM32 and Onenet Platform</b>	956
Zechao Shangguan, Shukun Cao, Chong Cao, Hongbin Wang	
<b>Improved RRT* path planning algorithm based on artificial potential field method</b>	961
Huimin Chen, Peilin Dou, Zhen Wang, Huizhong Zhang	
<b>Key technology for intelligent detection of colour defects in the clothing</b>	966
Wenkai Yang, Yongbin Zhang, Xiuli Fu, Yuansheng Qi	
<b>Improved Kernel Fuzzy C-Means Clustering Method Based on Smart Grid</b>	970
Shuqi Niu, Zhao Zhang, Xintong Tian, Xueyan Zhao	
<b>Dynamic scene SLAM algorithm based on semantic information and joint constraints of optical flow and geometry</b>	974
Jinyan Li, Xiangde Liu, Yi Zhang, Yunchuan Hu	
<b>QMIX Multiple Intelligences Reinforcement Learning Damping Control for Cylindrical Shell</b>	980
Song Yang, Kai Xu, XueHua Su, Gang Zhang	
<b>Application study of PointNet++ and hybrid filtering based point cloud denoising and segmentation algorithms for BliSk</b>	990
Xiaohang Gan, Libin Tan, Xiaoyi Wang	

<b>Design of Virtual Commissioning System for Intelligent Manufacturing Production Line Based on Digital Twin</b>	995
Taihu Lian, Meng Ran, Wei Zhao, Pengxin Liu	
<b>Modeling of manufacturing resources towards an interactive Resource Social Network</b>	1001
Cheng Qian, Yingfeng Zhang	
<b>Research on Cluttered Object Recognition Algorithm Based on Improved YOLO V5</b>	1005
Siqi Li, Bing Li, Ting Wang, Zhaoxiang Dong, Yuanbin Wang, Haibo Huang	
<b>Research on Facial Expression Recognition Algorithm Based on Deep Learning</b>	1010
Ying Zhang, Di Peng, Yi Wang, Jiaqi Wang	
<b>An Improved SURF Algorithm with FREAK Descriptor for BGA Component Image Stitching</b>	1014
Feng Chen, Jieli Deng	
<b>Clustering analysis of user load characteristics under new power system based on improved <i>k</i>-means clustering algorithm</b>	1019
Chao Zhang, Cheng Huang, Yi Wang, Wenran Shi, Yuxin Xie, Weijun Chen	
<b>Intelligent Itinerant Inspection Technology of Aircraft Based on Deep Learning and AR</b>	1023
Yingpeng Xu, Jianjun Tang, Jian Zhou, Qi Cheng, Junhao Geng	
<b>Intelligent diagnosis of tinnitus using electroencephalography</b>	1028
Zhaobo Li, Xinzui Wang	
<b>Colour selection for mosaic tiles based on FCM clustering algorithm</b>	1032
Zuhao Hou, Conghui Li, Yichun Luo, Qi Li, Jianye Xue	
<b>An Intelligent Temperature Prediction Method Based on PSO-ELM</b>	1036
Hongyuan Jiao, Erdong Chen	
<b>Research progress and trend analysis of virtual manufacturing based on CiteSpace</b>	1040
Yunfeng Li, Anran Zhao, Peng Liu, Guotai Huang	
<b>Research on Characteristic Diagnostic Control Method of Multivariate Quality Based on Fruit Fly Optimization Algorithm</b>	1044
Xianlin Ren, Laixian Chen, Chengrui Han, Yiduo Tian	
<b>Intelligent monitoring system for motor equipment based on Internet of Things</b>	1049
Wenlong Li, Lei Chen, Lijun Wei, Zhenao Li	
<b>Improved garment detection algorithm based on YOLOv5</b>	1054
Fenghua Liu, Hongsheng Zhao, Weiguang Liu	
<b>Markov blanket-embedded PSO algorithm for Bayesian network structure learning</b>	1059
Yikang Chen, Kun Liu, Yu Zhang	
<b>Pressure Balanced Regulation of Dual Common Rail Injection System by Neural Network Structural PID</b>	1067
Jun Wang, Yanbin Liu	
<b>Study on the Smart Logistics Supply Chain Path for Smart Manufacturing Enterprises in the Post-Epidemic Era ----- Taking Dongguan BG Technology Co. as an Example</b>	1071
Fei Lei, Xiaoshuang Yi, Yifang Zhan, Xuehua Lv, Qi Xiao, Ziming Tong, Shixing Lei	
<b>Garment Pattern Recognition Method based on Artificial Intelligence Algorithm</b>	1076
Bingchen Gou, Chengfeng Cai, Qilong Kang, Qinglei Meng, Yunlong Wei	

<b>Surface Defect Detection of Parts Based on the YOLOv5 Algorithm</b>	1080
Zechao Li, Yongbin Zhang, Xiuli Fu, Yuansheng Qi	
<b>Multi-party Secure Privacy Computation Based on Secrecy Coding</b>	1084
Cong Hu, Ting Lei, Shuang Wang, Cuicui Zhang, Jiali Sun, Cuiling Liu, Peng Wang	
<b>Cotton Packaging Defect Detection Based on Improved SVM Algorithm</b>	1088
Bowen Zheng, Huacai Lu, Xiuyun Zeng	
<b>A Review and Comparison on Video Stabilization Algorithms</b>	1093
Li Shi, Hong He	
<b>Path Planning of Mobile Robot Based on Improved A* Algorithm</b>	1098
Ju Gao, Xiangrong Xu, Xingning Zhang, Shanshan Xu, Quancheng Pu	
<b>Full life cycle carbon footprint assessment of circular saw blades based on design feature modelling</b>	1103
Hongpeng Lv, Yang Sun, Shuowei Bai, Jirong Wang, Junwei Ju	
<b>Study of metal 3D printing stepper motor control based on S- trapezoid algorithm</b>	1107
Xianyang Hao, Guofeng Xia, Shiyong Zhang, Zhongyuan Zhou, Mingjian Du, Xiangju Ding	
<b>Intelligent Monitoring Method of Crude Fuel Images Based On Deep Learning</b>	1112
Siwei Shao, Chenglin Yang, Lin Feng	
<b>Analysis of manufacturing cost of large civil aircraft based on RBF neural networks</b>	1116
Guangsheng Cao, Li Wang, Feng Yu, Maoru Gan	
<b>Dynamic Modelling and Analysis of a Novel Redundantly Actuated Parallel Spindle Head</b>	1120
Kailong Wang, Zhen He, Chengyang Wu, Fufu Yang, Jun Zhang	
<b>Combining the YOLOv5 and Grabcut algorithms for fashion color analysis of clothing</b>	1126
Fenghua Liu, Zhaoqi Liu, Weiguang Liu, Hongsheng Zhao	
<b>An Improved Ant Colony Algorithm Based Dynamic Sorting Strategy: Application to Delta Robot</b>	1130
Yisheng Hu, Haoyang Liu, Chengjin Hu, Jun Zhang	
<b>Ultrasonic beamforming algorithm based on deep learning and optimal model selection</b>	1137
Qiong Zhang, Zhengnan Yin, Yonghai Kuang	
<b>A Hybrid Genetic Algorithm for Flexible Job Shop Scheduling Problem</b>	1144
Xianglong Wang, Changyi Liu	
<b>Intelligent Manufacturing Line Design Based on Parallel Collaboration</b>	1149
Yu Xia, Xiaojun Guo	
<b>Study on a Fast Algorithm Model for Creep Rupture Damage of Turbine Blade Based on Engine Life Management</b>	1153
Haiyan Zhu, Shidian Shen, Quanzhong Wang, Jiawei Yu, Xing Ai, Yanyun Zhao	
<b>Modeling and Testing Analysis of Prepositioning Accuracy of CNC Turret</b>	1157
Jie Yang, Manxin Wang, Yibo Yang, Lanbin Li, Haibin Lai, Minghao Wang	
<b>Safety analysis of diesel hydrogenation unit based on a semi-quantitative risk assessment method</b>	1167
Liang Du, Guojin Zhang, Yonghang Cheng, Xiushan Shi	

<b>Optimization analysis of manufacturing process path of shift fork parts under the background of intelligent manufacturing</b>	1174
Zhenzhen Li, Yanhua Shi, Zhen Wei, Chong Zhang, Yanlong Xu, Bin Chen, Degen Chen, Siyong Wang	
<b>Development of Small Intelligent Production Line for Cylinder Liner</b>	1179
Yanhua Shi, Zhenzhen Li, Jiwen Xu, Bin Chen, Degen Chen, Siyong Wang, Wanpeng Li, Xiaojun Jiang	
<b>Research on intelligent manufacturing of automobile production based on big data</b>	1185
Hao Xu, Jinzhou Lin, Lin Liu, Tao Zhao, Jian Wu, Xinzhu Liu	
<b>Multi-Level Rolling Horizon Planning and Scheduling Integrated with Material Constraints using DBR Approach: A Heuristic for Smart Manufacturing</b>	1192
Mengjun Liu, Jabir Mumtaz, Gang Li	
<b>A Lightweight Network for Real-time Target Semantic Segmentation Based on Dual paths</b>	1198
Huaishu Hou, Yujie Meng, Jinghao Li, Chaofei Jiao, Jicai Shen, Shuaijun Xi	
<b>Simulation of Shot Peening Process For GH4169 Superalloy</b>	1203
Md Bilash Mehedi, Liang Tan	
<b>Enhancing Monte-Carlo Tree Search with Multi-Agent Deep Q-Network in Open Shop Scheduling</b>	1210
Oliver Lohse, Aaron Haag, Tizian Dagner	
<b>Industrial Operation Training Technology Based on Panoramic Image and Augmented Reality</b>	1216
Mengbo Chen, Huirong Wei, Hao Hu, Ruiyang Liu, Junhao Geng	
<b>Author Index</b>	