

2021 International Conference on Electronics, Circuits and Information Engineering (ECIE 2021)

**Zhengzhou, China
22 – 24 January 2021**



**IEEE Catalog Number: CFP21AE2-POD
ISBN: 978-1-6654-4810-9**

**Copyright © 2021 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:	CFP21AE2-POD
ISBN (Print-On-Demand):	978-1-6654-4810-9
ISBN (Online):	978-1-6654-1869-0

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

CURRAN ASSOCIATES INC.
proceedings
.com

2021 International Conference on Electronics, Circuits and Information Engineering (ECIE) **ECIE 2021**

Table of Contents

Preface **xiii**.....
Committee Members **xv**.....
Reviewers **xvi**.....

Circuit Design and Electronic Technology Research and Application

Wideband MIMO Antenna System for Sub-6 GHz Cell Phone .1.....
*Zhuo Zheng (University of Science and Technology of China, China), J.D
Ntwangaheza (University of Science and Technology of China, China),
and Liguo Sun (University of Science and Technology of China, China)*

First-Principles Study on the Threshold Switch Selector Graphene/H-BN/Graphene and the
Improvement of Its Performance .6.....
*Lihua Huang (Anhui University, China), Yuehua Dai (Anhui University,
China), Jianhua Gao (Anhui University, China), Peng Wang (Anhui
University, China), Renjie Ding (Anhui University, China), and Feifei
Wang (Anhui University, China)*

Research on Insulation Protection of High Voltage and High Power Confluence Structure of
Aerospace Based on Electric Field Simulation .10.....
*Yu Zhang (Beijing Satellite Manufacturing Co., Ltd, China), Guoshuai
Zhang (Beijing Satellite Manufacturing Co., Ltd, China), Jianchao Wu
(Beijing Satellite Manufacturing Co., Ltd, China), and Xingzheng Pei
(Beijing Satellite Manufacturing Co., Ltd, China)*

State of Health Prediction for Battery Based on Ensemble Learning .16.....
*Guangze Li (Chang'an University, China), Qingling Chu (Chang'an
University, China), Zhanshuo Wang (Chang'an University, China), and Li
Li (Chang'an University, China)*

Bandpass Filtering Power Divider with High Selectivity and Wide Stopband Based on
Integrated Substrate Gap Waveguide .20.....
*Weida He (Yunnan University, China), Dongya Shen (Yunnan University,
China), Xiupu Zhang (Concordia University, Canada), and Zhidong Ruan
(Yunnan University, China)*

Research on Selection Method of Service Security Link in Power Communication Network .24.....	
	<i>Xu Liu (Guizhou Power Grid Co., Ltd., China), Wei Tang (Guizhou Power Grid Co., Ltd., China), Wu Dong (Guizhou Power Grid Co., Ltd., China), Qi Tang (Guizhou Power Grid Co., Ltd., China), Hai Jin (Guizhou Power Grid Co., Ltd., China), and Zhen Pan (Guizhou Power Grid Co., Ltd., China)</i>
Design of Fully Differential Balanced Photoelectric Detection Circuit for Time Domain Interference System .28.....	
	<i>Kejuan Xue (Changchun University of Science and Technology, China), Jinsong Wang (Changchun University of Science and Technology, China), Ruizhi Wang (Changchun University of Science and Technology, China), and Ying Liu (Changchun University of Science and Technology, China)</i>
On the Technology of Frequency Hopping Communication Network-Station Selection .35.....	
	<i>Jiaxi Man (National University of Defense Technology), Wei Li (National University of Defense Technology), Hong Wang (National University of Defense Technology), and Weidong Ma (National University of Defense Technology)</i>
A New Flexible Radio Frequency Microstrip Used in Cryostat .42.....	
	<i>Fanqi Xu (Soochow University, China), Heng Lu (Soochow University, China), Chen Yang (Soochow University, China), Ye Tian (Soochow University, China), Fengnan Chen (Soochow University, China), Ying Yan (Soochow University, China), and J. Moser (Soochow University, China)</i>
Design of Communication Power Centralized Remote Monitoring System Based on Big Data Technology .46.....	
	<i>Lixia Zhang (State Grid Information and Communication Company of Shanxi Electric Power Company, China), Yang Li (State Grid Information and Communication Company of Shanxi Electric Power Company, China), Bijie Qiu (State Grid Information and Communication Company of Shanxi Electric Power Company, China), Jianliang Zhang (State Grid Information and Communication Company of Shanxi Electric Power Company, China), and Weiwei Liang (State Grid Information and Communication Company of Shanxi Electric Power Company, China)</i>
Tripe-Band MIMO Antenna for 5G Mobile Terminals .50.....	
	<i>Zhangyuan Zhao (Soochow University, China), Dong Ma (Soochow University, China), Canyon Zhu (Soochow University, China), and Peilin Huang (China Railway SiYuan Survey & Design Group Co. Ltd, China)</i>
A Study of Abaltion Zone of Irreversible Electroporation in a Heterogeneous Potato Model .55.....	
	<i>Fanning Liu (Shanghai University, China), Wenjun Zhang (Shanghai University, China), and Bing Zhang (Shanghai University, China)</i>
Leds' Working Principle and Its Technological Breakthrough of Gan .60.....	
	<i>Wutong Dong (Zhengzhou Middle School, China)</i>
Study of Perovskite-Based Self-Driving Photodetectors with Schottky Junction Configuration .65.....	
	<i>Haoyu Zhang (Soochow University, China), Guoyang Cao (Jiangnan University, China), Ke Li (Soochow University, China), and Xiaofeng Li (Soochow University, China)</i>

Study on Electrical Conductivity Measurement System of Porcine Liver Tissue .71.....	71
<i>Haoyu Jiang (China Academy of Telecommunication Research of Ministry of Industry and Information Industry, China) and Lei Yang (China Academy of Telecommunication Research of Ministry of Industry and Information Industry, China)</i>	
An Unbalanced Regulation Method Based on the Optimized Modulation Strategy of Three-Level Four-Arm Inverter .76.....	76
<i>Shengsuo Niu (North China Electric Power University, China) and Qianli Sha (North China Electric Power University, China)</i>	
Performance Analysis of Axial Flow Left Ventricular Assist Devices under Different Working Modes Based on the Numerical Model .81.....	81
<i>Yiming Wang (Shandong University, China), Yunpeng Zhang (Shandong University, China), and Xiangyu Wu (Shandong University, China)</i>	
Low Noise, High Accuracy Analog Electrocardiogram (ECG) Signal Front End Amplifier for Wearable Equipment .85.....	85
<i>Xin Sun (Vanderbilt University, USA)</i>	
Power Marketing Inspection Model Based on Multi-branch Residual Attention Network .89.....	89
<i>Hongbo Wu (State Grid Henan Economics Research Institute, China), Yiming Li (State Grid Henan Economics Research Institute, China), Linjuan Zhang (State Grid Henan Economics Research Institute, China), Chao Qiu (State Grid Henan Economics Research Institute, China), and Qi Li (State Grid Henan Economics Research Institute, China)</i>	
Abnormal Data Detection of Power Marketing Audit Based on DSR-Net .94.....	94
<i>Yiming Li (State Grid Henan Economics Research Institute, China), Linjuan Zhang (State Grid Henan Economics Research Institute, China), Changqing Xu (State Grid Henan Economics Research Institute, China), Lili Wang (State Grid Henan Economics Research Institute, China), and Chao Qiu (State Grid Henan Economics Research Institute, China)</i>	
Design and Simulation of Drawer Alarm .99.....	99
<i>Zhao Yang (Anhui Xinhua University, China) and Rui Wu (Anhui Xinhua University, China)</i>	
Research on Tracking Relationship Establishing Method of Train Control System Requirements Specification Based on Labeled-LDA .103.....	103
<i>Yixian Wang (Beijing Jiaotong University, China) and Tao Tang (Beijing Jiaotong University, China)</i>	
Design of Synchronous Feeding Device for Runwaystyle Breeding Pond .108.....	108
<i>Wenwu Mao (Shanghai Ocean University, China), Siyuan Wu (Shanghai Ocean University, China), Dengkui Wang (Shanghai Ocean University, China), and Chunxiang Lu (Shanghai Ocean University, China)</i>	
Research on the Transient Vibration Characteristics of Vehicle Transmission System .112.....	112
<i>Xuewu Liu (GAC Automotive Research, China), Chen Zhang (GAC Automotive Research, China), Xiaoming Ling (GAC Automotive Research, China), and Xinglei Shi (GAC Automotive Research, China)</i>	
Analysis and Research on Complex System of Power Grid Company Assets Management Targets and Functions under the Optimum of Overall Situation .118.....	118
<i>Jia-Xu Cheng (State Grid Energy Research Institute Co., Ltd, China), Guan-Ran Wang (North China Electric Power University, China), and Han Wang (State Grid Energy Research Institute Co., Ltd, China)</i>	

Research Status and Future Development of Wall-Climbing Robot .122.....	
	<i>Siyuan Wang (Hebei University of Engineering)</i>
Experimental and Theoretical Study on Stick-Slip Behaviour of Contact Pair Based on Real Contact State Evolution .131.....	
	<i>Jingyu Han (Tsinghua University, China), Baojiang Song (Tsinghua University, China), Zhijun Luo (Tsinghua University, China), and Shanze Yan (Tsinghua University, China)</i>
Review of Piezoelectric Material Power Supply .136.....	
	<i>Gaojian Ren (China Coal Technology and Engineering Group Chongqing Research Institute, China)</i>
Uncertainty Analysis of Ship Shafting Bearing Load under the Variational Elevation Based on Stochastic Finite Element .140.....	
	<i>Lixun Lu (Dalian Maritime University), Guobin Li (Dalian Maritime University), Shihao Qiu (Dalian Maritime University), Honglin Gao (Dalian Maritime University), Pengfei Xing (Dalian Maritime University), Xiaoliang He (Dalian Maritime University), and Hongpeng Zhang (Dalian Maritime University)</i>
Analysis of the Inherent Characteristics of a Gearing System .145.....	
	<i>He Lin (Xi' an Polytechnic University, China), Wenkuan Qu (Xi' an Polytechnic University, China), and Kun Qu (Xi' an Polytechnic University, China)</i>
Variational Autoencoder Based Approach for Imbalance Process Fault Detection .149.....	
	<i>Kehan Wang (Boston University, US)</i>
Application of Cycloidal Pin Wheel Planetary Reducer in the Design of Digging Machine .153.....	
	<i>Fang Xie (Xijing University of Mechanical Engineering, China), Long Li (Weinan Institute of Technicians, China), Guipeng Zhang (Xijing University of Mechanical Engineering, China), and Xinwei Hu (Xijing University of Mechanical Engineering, China)</i>
The Development of the Geometric Angle Measuring Instrument for Lathe Tool Based on Single Chip .157.....	
	<i>Xiaocui Zhu (Jilin University, China), Boxiao Li (Jilin University, China), Jili Wang (Jilin University, China), Chunguang Li (Jilin University, China), and Wei Hu (Jilin University, China)</i>
Systematic Error Elimination Method for Mechanical Stability Test Data .161.....	
	<i>Jie Bai (Beijing Institute of Space Mechanics & Electricity), Zijia Liu (Beijing Institute of Space Mechanics & Electricity), and Yixuan Sun (Beijing Institute of Space Mechanics & Electricity)</i>
Influence of Nozzle Structure on Steam Ejector Performance .165.....	
	<i>Linjing Hu (Inner Mongolia University of Technology, China), Jingshuai Wang (Inner Mongolia University of Technology, China), and Zhaoze Guo (Inner Mongolia University of Technology, China)</i>
Mechanical and Thermal Performance Analysis of Optical Components with Integrated Function and Structure .171.....	
	<i>Tiancong Luo (National University of Defense Technology, China), Xiaoqiang Peng (National University of Defense Technology, China), Yupeng Xiong (National University of Defense Technology, China), and Jiahao Yong (National University of Defense Technology, China)</i>

Application Analysis of Measurement Technology in Machinery Manufacturing and Large-Scale Machinery Installation .175.....	
	<i>Guoming Wu (Sichuan Vocational & Technical College, China)</i>
State Assessment of Rolling Bearings Based on the Multiscale Bubble Entropy .179.....	
	<i>Jinbao Zhang (China North Vehicle Research Institute, China), Cheng Wang (China North Vehicle Research Institute, China), Peng Gui (China North Vehicle Research Institute, China), Min Wang (China North Vehicle Research Institute, China), and Tiangang Zou (China North Vehicle Research Institute, China)</i>
Effect of Layer Cooling Control Process on Warpage of Q690D Low Carbon Bainitic Steel .183.....	
	<i>Xiao-Li Tian (University of Science and Technology Beijing, China), Wen-Jun Liu (Inner Mongolia HuiNeng Coal Chemical Co., Ltd., China), and Jie Guo (The First Geological Brigade of Hebei Bureau of Geology and Mineral Resources, China)</i>
Research on the Machining of Thin Wall Stainless Steel Tube .188.....	
	<i>Lizhong Xiang (Zhejiang Dada Stainless Steel Co., ltd, China)</i>
Design of a Walking Feeding Device for Aquaculture .192.....	
	<i>Wenwu Mao (Shanghai Ocean University, China), Cheng Li (Shanghai Ocean University, China), Jiafeng Chen (Shanghai Ocean University, China), and Dengkui Wang (Shanghai Ocean University, China)</i>

Intelligent Algorithm and Information Data Recognition Processing

Antenna Tilt Optimization Scheme of UAV Base Station in Multi-cell Millimeter Wave Communication System .196.....	
	<i>Nini Wan (Northwest Normal University, China), Xiangdong Jia (Northwest Normal University, China), Yaping Lv (Northwest Normal University, China), and Letian Jing (Northwest Normal University, China)</i>
Construction of Intelligent Logistics Information Platform Based on Big Data Technology .200.....	
	<i>Guanyu Li (Shandong Institute of Commerce and Technology, China) and Zheng Wang (Shandong College of Tourism and Hospitality, China)</i>
Error Detection and Correction of TIADC Based on GA Optimization .205.....	
	<i>Cong Liu (Nantong University, China), Xiangdong Luo (Nantong University, China), Guangshan Niu (Nantong University, China), Xuetao Li (Nantong University, China), and Jianwei Zhang (Nantong University, China)</i>
Polyp Detection in CT Colonography Based on Online Learning .211.....	
	<i>Dongfang Shang (Shenzhen Great Elm Technology Co. Ltd, China), Haoyu Sun (Shenzhen Great Elm Technology Co. Ltd, China), and Guangnan Wang (Shanghai Dianji University, China)</i>
Research on Video Image Preprocessing for Monitoring Abnormal Behavior of Mechanical Operators .216.....	
	<i>Hongqi Luo (Beijing Technology and Business University, China), Zhixin Liu (Beijing Technology and Business University, China), and Xia Liu (Quality Management Branch of China National Institute of Standardization, China)</i>

An Improved Small Target Detection Method Based on Yolo V3	.220
<i>Gongguo Zhang (Chongqing University of Posts & Telecommunications, China) and Junhao Wei (Chongqing University of Posts & Telecommunications, China)</i>	
Research on Evaluation of Logistics Training Effect in Higher Vocational Colleges Based on Enterprise Demand	.224
<i>Jun Qiao (Shandong Institute of Commerce and Technology, China), Jie Sun (Shandong Institute of Commerce and Technology, China), and Yanling Fan (Shandong Institute of Commerce and Technology, China)</i>	
A Deep Learning-Based Super-Resolution Model for Bistatic SAR Image	.228
<i>Xi Cen (Xidian University, China), Xuan Song (Xidian University, China), Yachao Li (Xidian University, China), and Chunfeng Wu (China Sanjiang Space Group, China)</i>	
Comparative Research on Product Information Marketing Management of Cross-Border E-Commerce Platforms in the Post-Epidemic Era	.234
<i>Fei Lei (Guangdong University of Science and Technology, China), Mimi Shao (Xinhua College of Sun Yat-sen University, China), Junyi Lai (Guangdong University of Science and Technology, China), Fei Huang (Guangdong University of Science and Technology, China), and Xiaomei Liu (Guangdong University of Science and Technology, China)</i>	
Simulation and Analysis of Simultaneous Water-Filling Allocation Based on Fractional Frequency Reuse for 19-Cell Network	.240
<i>Hanqiao Chen (The University of Edinburgh, United Kingdom), Bowei Huang (Anhui Jianzhu University, China), and Chenwei Wu (Fudan University, China)</i>	
Analysis of a Mixed Neural Network Based on CNN and RNN for Computational Model of Sensory Cortex	.245
<i>Haoyue Yan (University of Toronto, Canada) and Chenwei Wu (Fudan University, China)</i>	
Overview of Au-Al Bond Interface	.250
<i>Shuang Xie (China Aerospace Science Corporation, China), Pengrong Lin (China Aerospace Science Corporation, China), and Quanbin Yao (China Aerospace Science Corporation, China)</i>	
A YOLOV3 System for Garbage Detection Based on MobileNetV3_Lite as Backbone	.254
<i>Wu Han (Wuhan University of Technology, China)</i>	
Analysis of On-Site Evaluation Methods of Network Security in the Evaluation of Information Security Level Protection	.259
<i>Dabin Sun (Guizhou Branch of National Computer Network Emergency Response Technical Team/Coordination Center of China) and Bowei Wang (Guizhou Branch of National Computer Network Emergency Response Technical Team/Coordination Center of China)</i>	
Blockchain Cross-Chain Protocol and Platform Research and Development	.264
<i>Ling Cao (Chongqing University of Posts and Telecommunications, China) and Bo Song (Chongqing University of Posts and Telecommunications, China)</i>	
Location and Ranging Process of TOA Algorithm Based on CSS Technology	.270
<i>Yijie Li (Guangdong Peizheng College, China)</i>	

Balance Control System of Grid Connected Inverter Circuit Based on the Improved Particle Swarm Optimization Algorithm .274.....	
	<i>Huixiu Li (Dalian University of Science and Technology, China)</i>
Research on Enterprise Level Cross Domain Integrated Data Inventory Method Based on DMAIC Model .278.....	
	<i>Ran Ran (State Grid Liaoning Electric Power Co., Ltd., China), Jun Qi (State Grid Liaoning Electric Power Co., Ltd., China), Qiang Gao (State Grid Liaoning Electric Power Co., Ltd., China), Yubo Liu (State Grid Liaoning Electric Power Co., Ltd., China), Liang Bai (State Grid Liaoning Electric Power Co., Ltd., China), and Xiaoqiang Liu (State Grid Liaoning Electric Power Co., Ltd., China)</i>
Application of Face Verification Based on Angular Margin Triplet in Train Diagram Management System .283.....	
	<i>Ning Wang (Beijing Jiaotong University, China), Qihong Yue (Beijing Jiaotong University, China), Tao Meng (China Railway Jinan Bureau Group Co., Ltd., China), Xiaoyong Chen (China Railway Jinan Bureau Group Co., Ltd., China), Dunlei Yuan (China Railway Jinan Bureau Group Co., Ltd., China), and Xiangqian Liu (Beijing Jiaotong University, China)</i>
Research on Compressed Sensing Algorithm Based on C-RAN Forward Link .291.....	
	<i>Jiaru Li (Beijing Jiaotong University, China) and Hongxian Tian (Beijing Jiaotong University, China)</i>
Multi-dimensional Decomposition Algorithm and Hardware Implementation for Ultra-Long Point FFT .300.....	
	<i>Di Wang (Jiangnan Institute of Computing Technology, China), Song Shi (Jiangnan Institute of Computing Technology, China), Tie-Bin Wu (Jiangnan Institute of Computing Technology, China), Liang Liu (Jiangnan Institute of Computing Technology, China), Hong-Bing Tan (Jiangnan Institute of Computing Technology, China), Zi-Yu Hao (Jiangnan Institute of Computing Technology, China), Feng Guo (Jiangnan Institute of Computing Technology, China), and Hong-Liang Li (Jiangnan Institute of Computing Technology, China)</i>
Visualization Analysis Method of Data Assets Hotspots in Power Enterprises Based on Data Middle Platform .306.....	
	<i>Qiang Gao (State Grid Liaoning Electric Power Co., Ltd., China), Ran Ran (State Grid Liaoning Electric Power Co., Ltd., China), Xiaoqiang Liu (State Grid Liaoning Electric Power Co., Ltd., China), Yubo Liu (State Grid Liaoning Electric Power Co., Ltd., China), Pan Hu (State Grid Liaoning Electric Power Co., Ltd., China), Mengtong Huang (State Grid Liaoning Electric Power Co., Ltd., China), and Jun Qi (State Grid Liaoning Electric Power Co., Ltd., China)</i>
Spatiotemporal Residual Network for Dynamic Scene Recognition Based on ResNeXt .310.....	
	<i>Xianqiang Xiong (Guangxi University, China) and Yu Sun (Guangxi University, China)</i>
Research on Tennis Recognition Technology Based on Computer Vision .316.....	
	<i>Lu Zhang (Information Engineering University, China)</i>

Load Identification Based on Optimized Fuzzy C-Means State Extraction .323.....	323
<i>Lu Peng (Hubei University of Technology, China), Fanrong Wang (Hubei University of Technology, China), Yang Liu (Hubei University of Technology, China), and Kun Xiang (Hubei University of Technology, China)</i>	
Fall Recognition Algorithm for the Elderly Based on Home Service Robot .329.....	329
<i>Xiao Li (Shanghai University, China) and Wanmi Chen (Shanghai University, China)</i>	
Application of Learning-Based Multi-view Stereo in Digital Design .336.....	336
<i>Ke Zhang (Shanghai Institute of Technology, China) and Mengyu Liu (Shanghai Institute of Technology, China)</i>	
The Realization of Key Algorithm of Mobile Internet Traffic Information Mining Based on Cloud Computing .341.....	341
<i>Xiaobo Li (Henan University of Engineering, China)</i>	
Research on Operational Effectiveness Evaluation of Network Information System Based on System Dynamics .345.....	345
<i>Jianfeng Hou (National Univ. of Defense Tech, China), Lei Wang (National Univ. of Defense Tech, China), Zhiqiang Lin (National Univ. of Defense Tech, China), and Mei Gao (National Univ. of Defense Tech, China)</i>	
Combat System Capability Analysis Method Based on Information Link Search .350.....	350
<i>Jin An (Jiangsu Automation Research Institute of CSSC, China) and Xin-An Wu (Jiangsu Automation Research Institute of CSSC, China)</i>	
Research on Obstacle Avoidance Control Method of Multi-UAV Based on Model Predictive Control .357.....	357
<i>Kewang Zheng (Chinese Flight Test Establishment, China) and Tenghuan Ding (Chinese Flight Test Establishment, China)</i>	
Study on Mechanical Behavior of Load-Bearing Rope of 340K Snubbing Operation Device under Wind Load .363.....	363
<i>Chunyuan Song (Sichuan Baoshi Machinery Drilling Equipment Co., Ltd., China), Shoulin Hu (China National Petroleum Corporation Oilfield Technology Service Co., Ltd., China), Yunbin He (China National Petroleum Corporation Oilfield Technology Service Co., Ltd., China), and Hai Yang (Sichuan Shengnuo Oil and Gas Engineering Technology Service Co., Ltd., China)</i>	
Overview of Research on 3D Path Planning Methods for Rotor UAV .368.....	368
<i>Zheng Yu (Shandong University of Science and Technology, China), Fuchun Sun (Tsinghua University, China), Xiao Lu (Shandong University of Science and Technology, China), and Yixu Song (Tsinghua University, China)</i>	
Cross-Modal Pedestrian Re-Identification Based on Generative Confrontation Network .372.....	372
<i>Jun Hu (Chongqing University of Posts and Telecommunications, China) and Xiaolin Li (Chongqing University of Posts and Telecommunications, China)</i>	
Author Index 377.....	377