

2022 IEEE 2nd International Conference on Digital Twins and Parallel Intelligence (DTPI 2022)

**Boston, Massachusetts, USA
24-28 October 2022**



**IEEE Catalog Number: CFP22AO7-POD
ISBN: 978-1-6654-9228-7**

**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:	CFP22AO7-POD
ISBN (Print-On-Demand):	978-1-6654-9228-7
ISBN (Online):	978-1-6654-9227-0

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

2022 IEEE 2nd International Conference on Digital Twins and Parallel Intelligence (DTPI)

Main IEEE DTPI Conference Session

<i>Optimal Power Flow of Low Carbon Power System Based on NSGA2 Algorithm and Carbon Flow Theory</i> Gangfei Wang (Qinghai University, China), Hengrui Ma (Qinghai University, China), Lidong Qin (Qinghai University, China), Shidong Wu (Qinghai University, China), Bowen Ren (Qinghai University, China)	1
<i>Evolutionary Deep Reinforcement Learning for Volt-VAR Control in Distribution Network</i> Ruiqi Si (Wuhan University, China), Tianlu Gao (Wuhan University, China), Yuxin Dai (Wuhan University, China), Yuyang Bai (Wuhan University, China), Yuqi Jiang (Wuhan University, China), Jun Zhang (Wuhan University, China)	7
<i>Short-Term State Electricity Load Forecasting Based on Transfer-Informer</i> Yuqi Jiang (Wuhan University, China), Yuxin Dai (Wuhan University, China), Ruiqi Si (Wuhan University, China), Jiuxiang Chen (Wuhan University, China), Tianlu Gao (Wuhan University, China), Jun Zhang (Wuhan University, China)	12
<i>Condition Monitoring of Wind Turbines Through Image Similarity Evaluation</i> Tianyu Wang (State Grid Zhejiang Electric Power Research Institute, China), Ye Su (State Grid Zhejiang Electric Power Co Electric Power Research Institute, China), Jiangfeng Zhang (State Grid Zhejiang Electric Power Co Electric Power Research Institute, China), Junyu Cai (State Grid Zhejiang Electric Power Co Electric Power Research Institute, China), Liyun Hua (Hangzhou E. Energy Technology Co. Ltd, China)	18
<i>Shadow Detection and Disparity Processing Based on Binocular Vision</i> Zhen Bai (Hubei University, China), Wenyi Lu (Hubei University, China), Jiangtao Peng (Hubei University, China), Ran Meng (Beijing Smarter Eye Technology Co. Ltd, China)	22
<i>Research and Implementation of a Grid-Source Coordination Management Platform Based on Dispatching and Control Cloud</i> Lina Lu (Hangzhou Dianzi University Information Engineering School, China), Chao Sun (Guodian Nanjing Automation Co. Ltd, China), Tianyu Wang (State Grid Zhejiang Electric Power Research Institute, China), Jiali Wu (China Ship Development and Design Center, China), Kaifeng Zhang (Southeast University, China), Zirui Huang (Southeast University, China)	26
<i>Analytical Design of Optimal Fractional Order PID Control for Industrial Robot Based on Digital Twin</i> Xuan Liu (Huazhong University of Science and Technology, China), Ying Luo (Huazhong University of Science and Technology, China)	30
<i>Smart Integrated Energy System Based on Digital Twin: Research, Application and Outlook</i> Xiaojie Lin (Zhejiang University, China), Wei Zhong (Zhejiang University, China), Yihui Mao (Zhejiang University, China), Nan Zhang (Zhejiang University, China)	37
<i>A Semantic Overlay on Blockchain for Supporting Traceability in Cross-Border Logistics</i> Xiaoping Sun (Chinese Academy of Sciences, China)	42
<i>Power Load Forecasting Method Based on Random Matrix Theory and CNN-LSTM Model</i> Shidong Wu (Qinghai University, China), Cunqiang Huang (Institute of Economic Technology State Grid Qinghai Electric Power Company, China), Xu Tian (Institute of Economic Technology State Grid Qinghai Electric Power Company, China), Junxian Li (Institute of Economic Technology State Grid Qinghai Electric Power Company, Italy), Bowen Ren (Qinghai University, China), Gangfei Wang (Qinghai University, China), Lidong Qin (Qinghai University, China), Hengrui Ma (Qinghai University, China)	46
<i>Design of Trans-Provincial Power Spot Trading Mechanism and Provincial Power Allocation System</i> Hao Zhang (Wuhan University, China), Hang Zhao (Wuhan University, China), Jiahao Xiong (Wuhan University, China), Peidong Xu (Wuhan University, China), Ke Zhang (Wuhan University, China), Yuxin Dai (Wuhan University, China), Haoran Zhang (Wuhan University, China), Jun Zhang (Wuhan University, China), Tianlu Gao (Wuhan University, China)	52
<i>Investigation of Building Load Calculation From the Perspective of Grand Canonical Ensemble Theory and Historical Data Identification</i> Junwei Zhang (Zhejiang University, China), Xiaojie Lin (Zhejiang University, China), Wei Zhong (Zhejiang University, China)	59
<i>Digital Twin Based Operation Support System of Nuclear Power Plant</i> Zikang Li (Harbin Engineering University, China)	64
<i>An Artificial Intelligence Driven Method for Power System Control Based on the Cloud-Edge Collaboration Architecture</i> Wenchen Li (China Electric Power Research Institute, China), Yanhao Huang (China Electric Power Research Institute, China), Chunjiang He (China Electric Power Research Institute, China), Chenglong Xu (Wuhan University, China), Peidong Xu (Wuhan University, China), Tianlu Gao (Wuhan University, China), Jun Zhang (Wuhan University, China)	70
<i>Pavement Crack Detection on BEV Based on Attention-Unet</i> Jia Zhang (Hubei University, China), Na Chen (Hubei University, China), Jiangtao Peng (Hubei University, China), Feng Cui (Beijing Smarter Eye Technology, China)	74
<i>Residential Short Term Load Forecasting Based on Federated Learning</i> Jiuxiang Chen (Wuhan University, China), Tianlu Gao (Wuhan University, China), Ruiqi Si (Wuhan University, China), Yuxin Dai (Wuhan University, China), Yuqi Jiang (Wuhan University, China), Jun Zhang (Wuhan University, China)	78

<i>Digital Spectrum Twinning for Next-Generation Spectrum Management and Metering</i>	
Gregory Durgin (Georgia Tech, USA), Michael Varner (Georgia Institute of Technology, USA), Neal Patwari (Washington University in St. Louis, USA), Sneha Kumar Kasera (University of Utah, USA), Jacobus Van der Merwe (University of Utah, USA)	82
<i>Human and Building Digital Twins for Virtual Reality Based Building Emergency Training</i>	
Ruying Liu (University of Southern California, USA), Burcin Becerik-Gerber (University of Southern California, USA)	88
<i>Enhanced RF Modeling Accuracy Using Simple Minimum Mean-Squared Error Correction Factors</i>	
Michael Varner (Georgia Institute of Technology, USA), Frost B Mitchell (University of Utah, USA), Jie Wang (Washington University in St. Louis, USA), Kirk Webb (University of Utah, USA), Gregory Durgin (Georgia Tech, USA)	90
<i>Medical Resource Allocation Based on Undesirable Outputs DEA Model</i>	
Wen Li (Hubei University, China), Yingxiong Fu (Hubei University, China), Yi Sun (Anhui University of Financ, China), Weiguo Chen (Beijing University of Technology, China)	95
<i>Weibo Spammer Detection Based on Social Network Digital Twin</i>	
Shao Wen Yu (China University of Petroleum, China), Qiang Li (China University of Petroleum, China), Dawei Yang (China University of Petroleum, China), Yu Yanru (CollChina University of Petroleum, China), HaiWen Wang (China University of Petroleum (East China), China)	99
<i>A Modeling Method of Driving Risk Assessment Based on Vehicle Trajectory Prediction</i>	
Xunjia Zheng (Chongqing University of Arts and Sciences, China), Huilan Li (Chongqing City Vocational College, China), Hui Liu (Chongqing University of Arts and Sciences, China), Xing Chen (Chongqing University of Arts and Sciences, China), Tianhong Luo (Chongqing University of Arts and Sciences, China)	104
<i>Link Flow Estimation for Parallel Transportation Management</i>	
Qiang Li (Guocheng Yitai Technology Development Co., Ltd, China), Runmeng Wang (National Energy Group Capital Holding Co Ltd, China)	108
<i>A Digital Twin City Model for Capturing Walkability Distress of Elderly Adults</i>	
Theodora Chaspari (Texas A&M University, USA), Jinwoo Kim (Texas AM University, USA), Chanam Lee (Texas AM University, USA), Youngjib Ham (Texas AM University, USA), SangHyun Lee (University of Michigan, USA), Changbum R. Ahn (Seoul National University, USA)	112
<i>Integrating Human Mobility and Infrastructure Design in Digital Twin to Improve Equity and Resilience of Cities</i>	
Chao Fan (Clemson University, USA)	114
<i>Optimizing Traffic Controllers Along the MLK Smart Corridor Using Reinforcement Learning and Digital Twin</i>	
Abhilasha Saroj (Georgia Institute of Technology, USA), Toan Tran (University of Tennessee at Chattanooga, USA), Angshuman Guin (Georgia Institute of Technology, USA), Michael Hunter (Georgia Institute of Technology, USA), Mina Sartipi (University of TN at Chattanooga, USA)	116
<i>Thermo-Mechanical Coupled Digital Simulation of Torque Sensor Based on Parallel Systems</i>	
Xueqin Wang (AVIC Changcheng Institute of Metrology&Measurement, China), Wanxin Hu (AVIC Changcheng Institute of Metrology and Measurement, China), Lemeng Qin (Beijing University of Technology, China)	118
<i>Research on Identification of Main Cotton Pests Based on Deep Learning</i>	
XingMao Liu (NingboTech University, China), Yihui Liu (Hefei University of Technology, China), Ming Xu (NingboTech University, China), Shuijiao Tang (NingboTech University, China), Zhandong Ma (Xinjiang Tianye Smart Agricultural Technology, China)	123
<i>Path Planning of Mobile Robot Based on an Improved Genetic Algorithm</i>	
Zenghua Chen (University of Chinese Academy of Sciences & College of Artificial Intelligence, China), Gang Xiong (Institute of Automation, Chinese Academy of Sciences, China), Sheng Liu (Institute of Automation, Chinese Academy of Sciences, China), Zhen Shen (Institute of Automation · Chinese Academy of Sciences, China), Yue Li (Chang'an University, China)	127
<i>Research on Parallel Control Strategy of Thermal Power Plant Operating Parameters</i>	
Junyu Cai (State Grid Zhejiang Electric Power Co Electric Power Research Institute, China), Jian Gao (Zhejiang Datang Wushashan Power Generation Company Limited, China), Baozhu Zhou (Zhejiang Datang Wushashan Power Generation Company Limited, China), Tianyu Wang (State Grid Zhejiang Electric Power Research Institute, China), Junwei Song (Zhejiang Datang Wushashan Power Generation Company Limited, China), Wang De Lei (Zhejiang SUPCON Technology Co. Ltd., China), Chen Zeng (Guo Neng Zhejiang Energy Development Company Limited, China), Deheng Ji (State Grid Zhejiang Electric Power Research Institute, China)	133
<i>A Case Study of Digital Twin for Greenhouse Horticulture Production Flow</i>	
Daniel Anthony Howard (University of Southern Denmark, Denmark), Zheng Ma (Center for Energy Informatics & University of Southern Denmark, Denmark), Bo Jørgensen (University of Southern Denmark, Denmark)	141
<i>A Digital Smart City for Emerging Mobility Systems</i>	
Raymond M Zayas (University of Delaware, USA), Logan E Beaver (Boston University, USA), Behdad Chalaki (University of Delaware, USA), Heeseung Bang (University of Delaware, USA), Andreas Malikopoulos (University of Delaware, USA)	147
<i>Modeling Methodology and In-Field Measurement Setup to Develop Empiric Weather Models for Solid-State LiDAR Sensors</i>	
Marcel Kettelgerdes (Technische Hochschule Ingolstadt, Germany), Gordon Elger (Fraunhofer IVI Applied Center Connected Mobility and Infrastructure, Germany)	153
<i>Parallel Intelligence in Semantic Digital Twins: An Interactive Decision-Support System for Indoor Comfort</i>	
Alex Donkers (Eindhoven University of Technology, The Netherlands), Duijuan Yang (Eindhoven University of Technology, USA)	159

<i>Smart Predictive Maintenance Enabled by Digital Twins and Smart Big Data: A New Framework</i>	
Furkan Guc (University of California Merced, USA), YangQuan Chen (University of California, Merced, USA)	165
<i>Chain Branch Leaf-Gateway, a Strategy for Dynamic Clustering and Optimal Coverage of Communication for Automated Mobility</i>	
Sabrine Belmekki (Université Gustave Eiffel & LEOST, France), Dominique Gruyer (Univ Gustave Eiffel, France), Charles Tatkeu (IFSTTAR, LEOST & Univ Lille Nord de France, France)	169
<i>STFL: Spatio-Temporal Federated Learning for Vehicle Trajectory Prediction</i>	
Xuehan Zhou (Beijing Jiaotong University, China), Ruimin Ke (University of Texas at El Paso, USA), Zhiyong Cui (Beihang University, China), Qiang Liu (University of Nebraska-Lincoln, USA), Wenxing Qian (Beijing Jiaotong University, China)	174
<i>Multi-Robot Distributed Coordination in IOT Systems: An ACP Framework</i>	
Jiazheng Zhang (Lanzhou University, China), Jingkun Yan (Lanzhou University, China), Xiujuan Du (Qinghai Normal University, China), Long Jin (Lanzhou University, China)	180
<i>Vision-Based UAV Autonomous Landing Systems</i>	
Junjie Yang (Changsha University of Science and Technology, China), Xuan Li (Shenzhen, Guangdong Province & Peng Cheng Laboratory, China)	188
<i>Integrated Optimization of Smart Home Appliances Under Energy Management System</i>	
Jing Li (Jining Power Supply Company of State Grid Shandong Electric Power, China), Xiangyu Zhou (Jining Power Supply Company of State Grid Shandong Electric Power, China), Tao Lin (Jining Power Supply Company of State Grid Shandong Electric Power, China), Yue Liu (Jining Power Supply Company of State Grid Shandong Electric Power, China), Qinghua Wu (Jining Power Supply Company of State Grid Shandong Electric Power, China)	192
<i>Optimal Control and Configuration of Energy Storage Devices in Regional Distribution Network With Renewable Energy Sources</i>	
Xiangyu Zhou (Jining Power Supply Company of State Grid Shandong Electric Power, China), Jing Li (Jining Power Supply Company of State Grid Shandong Electric Power, China), Yao Meng (Jining Power Supply Company of State Grid Shandong Electric Power, China), Wenxiu Dong (Jining Power Supply Company of State Grid Shandong Electric Power, China), Hedong Zhang (Jining Power Supply Company of State Grid Shandong Electric Power, China)	196
<i>Digital Twin Network Based Network Slice Security Provision</i>	
Ke Wang (China Mobile Research & Institute, China), Li Su (Chinamobile Research Institute, China), Haitao Du (CMRI, China)	201
<i>Semi-Supervised Regression Under Federated Learning Framework Based on Partial Information Estimation</i>	
Tang Xilin (China), Liu Guanfu (China)	207
<i>Terms Development of Additive Manufacturing</i>	
Tariku Sinshaw Tamir (University of Chinese Academy of Sciences, Institute of Automation, China)	211
<i>End to End Autonomous Driving Behavior Prediction Based on Deep Convolution Neural Network</i>	
Yinlin Wang Wang (Yanshan University, China)	216
<i>An Industrial Equipment Maintenance Support System for Networked Collaborative Evolution in the Smart Product Service Ecosystem</i>	
Yu-Guang Bao (Shanghai Jiao Tong University, China), Zhao-Hui Sun (Shanghai Jiao Tong University, China), Xiao-Qiang Liao (Shanghai Jiao Tong University, China), Yuan Chang (Shanghai Jiao Tong University, China), Siqi Qiu (Shanghai Jiao Tong University, China), Xinguo Ming (Shanghai Jiao Tong University, China)	222
<i>Parallel Control Strategy for Flexible Operation of Ultra-Supercritical Units Under Digital Twin Theory</i>	
Ting Huang (North China Electric Power University, China), Guolian Hou (North China Electric Power University, China)	228
<i>Design and Application of Parallel Intelligent Control System for Denitration System in Coal-Fired Power Plant</i>	
Quan Li (Hangzhou E. Electric Technology Co., Ltd., China), Feng Yin (State Grid Zhejiang Electric Power Co. Ltd. Institute of Electric Power Science, China), Jiangfeng Zhang (State Grid Zhejiang Electric Power Co. Ltd. Institute of Electric Power Science, China), Jiandong Sun (Hangzhou E. Electric Technology Co. Ltd., China), Libin Dong (Zhejiang Datang Wushashan Power Generation Co. Ltd, China), Ye Su (State Grid Zhejiang Electric Power Co. Ltd. Institute of Electric Power Science, China)	232
<i>Design and Application of A Parallel Agent</i>	
Libin Dong (Zhejiang Datang Wushashan Power Generation Co. Ltd, China), Quan Li (Hangzhou E. Electric Technology Co., Ltd., China), Jiandong Sun (Hangzhou E. Electric Technology Co. Ltd., China)	238
<i>Parallel Control of Ultra-Supercritical Unit Under Requirements of Flexible Operation</i>	
Linjuan Gong (Xi'an Thermal Power Research Institute Co., Ltd, China), Guolian Hou (School of Control and Computer Engineering, China), Lin Wang (Xi'an Thermal Power Research Institute Co., Ltd, China), Yaokui Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Wenyu Wang (Xi'an Thermal Power Research Institute Co., Ltd., China), Zhangming Zhao (Xi'an Thermal Power Research Institute Co., Ltd, China), Jun Tang (Northern United Power Co. Ltd., China), Hongri Guo (Northern United Power Co. Ltd., China), Jian Liang (Northern United Power Co. Ltd., China)	243

Architecture of Intelligent Operation Center for Thermal Power Unit

Yaokui Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Haidong Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Lin Wang (Xi'an Thermal Power Research Institute Co., Ltd, China), Linjuan Gong (Xi'an Thermal Power Research Institute Co., Ltd, China), Wenyu Wang (Xi'an Thermal Power Research Institute Co., Ltd., China), Yangxiang Lei (Xi'an Thermal Power Research Institute Co., Ltd, China), Jianguo Wu (Huaneng Weihai Power Generation Co., Ltd, China), Xinbo Yu (Huaneng Weihai Power Generation Co., Ltd, China), Guangqing Sun (Huaneng Weihai Power Generation Co., Ltd, China) 248

Research on Edge Cloud Architecture of Intelligent Power Plant

Zhangming Zhao (Xi'an Thermal Power Research Institute Co., Ltd, China), Lin Wang (Xi'an Thermal Power Research Institute Co., Ltd, China), Ling Zha (Xi'an Thermal Power Research Institute Co., Ltd, China), Wenyu Wang (Xi'an Thermal Power Research Institute Co., Ltd., China), Linjuan Gong (Xi'an Thermal Power Research Institute Co., Ltd, China), Yaokui Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Haidong Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Yangxiang Lei (Xi'an Thermal Power Research Institute Co., Ltd, China), Jinghao Dong (Xi'an Thermal Power Research Institute Co., Ltd, China) 252

Digital Twin-Assisted Lane-Changing and Variable Speed Limit Control for Weaving Segments

Tingting Fan (The Hong Kong Polytechnic University, Hong Kong), Ivan Wang-Hei Ho (The Hong Kong Polytechnic University, Hong Kong), Edward Chung (The Hong Kong Polytechnic University, Hong Kong) 255

A Driving Strategy Based Integrated Rescheduling Model for High-Speed Railway by Using the Parallel Intelligent Method

Fan Liu (Beijing Jiaotong University, China), Jing Xun (Beijing Jiaotong University, China), Zhou Min (Beijing Jiaotong University, China), Shibo He (Zhejiang University, China), Dong Hai Rong (Beihang University, China) 260

A Novel Recurrent Neural Network for Dynamic Process Modeling With Inertia and Delay

Lin Gao (Thermal Power Research Institute Co., Ltd, China), Pan Zhao (Xi an Jiaotong University, China), Lin Wang (Xi an Thermal Power Research, China), Haidong Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Yaokui Gao (Xi'an Thermal Power Research Institute Co., Ltd, China), Ming Liu (Xi an Jiaotong University, China) 266

Leverage Digital Twins Technology for Network Lifecycle Management

Da Wang (AsiaInfo Technologies (China), Inc, China), Jianchao Guo (AsiaInfo Technologies (China), Inc., China), Ye Ouyang (AsiaInfo Technology Co., Ltd., USA), Shoufeng Wang (AsiaInfo Technologies, China), Aidong Yang (AsiaInfo Technologies, China), Zhidong Ren (AsiaInfo Technologies China, China), Ying Ding (AsiaInfo Technologies, China), Guo Chen (AsiaInfo Technologies (China), Inc., China), Cheng Zhou (China Mobile Research Institute, China), Danyang Chen (China Mobile Research Institute, China) 270