

# **2022 WRC Symposium on Advanced Robotics and Automation (WRC SARA 2022)**

**Beijing, China  
20 August 2022**



**IEEE Catalog Number: CFP22Q58-POD  
ISBN: 978-1-6654-6370-6**

**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:	CFP22Q58-POD
ISBN (Print-On-Demand):	978-1-6654-6370-6
ISBN (Online):	978-1-6654-6369-0

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

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# Table of Contents

Saturday, August 20, 2022

SaC1A	Room A
<b>Poster Session (Poster Sessions)</b>	
09:45-10:15	SaC1A.1
<i>Application of Generative Adversarial Networks in Gesture Recognition</i> , pp. 1-6.	
Zhu, Wendi	Changchun University of Science and Technology
Yang, Yang	Changchun University of Science and Technology
Chen, Lina	Changchun University of Science and Technology
Xu, Jinyu	Changchun University of Science and Technology
Zhang, Chenjie	Changchun University of Science and Technology
Guo, Hongxi	Changchun University of Architecture and Civil Engineering
09:45-10:15	SaC1A.2
<i>Design and Analysis of End-Effector for Multi-Target Spatial Operation</i> , pp. 7-12.	
Deng, Songbo	Beijing Institute of Precision Mechatronics and Control
Duan, Jiaqi	Beijing Institute of Precision Mechatronics and Control
Yang, Zelin	Beijing Institute of Precision Mechanical and Electrical
Zhi, Jiankang	Beijing Institute of Precision Mechatronics and Control
Cai, He	Beijing Institute of Precision Mechatronics and Control
Yang, Tao	Beijing Institute of Precision Mechanical and Electrical
Wang, Yanbo	Beijing Institute of Precision Mechatronics and Control
09:45-10:15	SaC1A.3
<i>Calibration of Serial Robots through Integration of Local POE Formula and Artificial Neural Networks</i> , pp. 13-18.	
Song, Yongbin	University of Warwick
Tian, Yanling	University of Warwick
Ma, Yiwei	University of Warwick
09:45-10:15	SaC1A.4
<i>A Screw Theory-Based Approach for Conservative Stiffness Mapping of 3-PRS Parallel Mechanism</i> , pp. 19-24.	
Ma, Yiwei	University of Warwick
Tian, Yanling	University of Warwick
Song, Yongbin	University of Warwick
09:45-10:15	SaC1A.5
<i>Overview of the Application of Unmanned Aerial Vehicles in the Arctic Atmospheric Observation System</i> , pp. 25-32.	
Huang, Xindi	Chinese Academy of Sciences
Liu, Tiejun	Shenyang Institute of Automation, Chinese Academy of Sciences
Liu, Haobo	Chinese Academy of Sciences
Wang, Hailin	Chinese Academy of Sciences
09:45-10:15	SaC1A.6
<i>A Hybrid Paradigm Based on Steady-State Visual Evoked Potentials and Motor Imagery</i> , pp. 33-37.	
Li, Jiaxin	Yanshan University
Zhao, Jing	Yanshan University
Shi, Ye	Yanshan University
09:45-10:15	SaC1A.7
<i>Design of Dictyophora Rubrovalvata Picking Robot</i> , pp. 38-42.	
Liu, Quan	Beijing Information Science and Technology University
Pan, Mengmeng	Beijing Information Science and Technology University
Wang, Shuoming	Beijing Information Science and Technology University
09:45-10:15	SaC1A.8
<i>Optimal Control Method of Motor Torque Loading Based on Active Disturbance Rejection Control (I)</i> , pp. 43-47.	
Zhan, Gan	Beijing Institute of Technology
Zhang, Wencai	Beijing Institute of Technology
Li, Tianzhen	Beijing Institute of Technology
Xin, Zhanhua	Beijing Institute of Technology
wang, dong	Beijing Institute of Technology
Dong, Xinyi	Beijing Institute of Technology

Niu, Shaohua	Beijing Institute of Technology
09:45-10:15	SaC1A.9
<i>Design of Photovoltaic Glass Automatic Stacking and Paper Laying Robot</i> , pp. 48-52.	
Pan, Shuo	Beijing Information Science and Technology University
Liu, Bin	Beijing Institute of Technology
YE, Lingbo	Beijing Information Science and Technology University
09:45-10:15	SaC1A.10
<i>Design and Research for Industrial Robot Using Goods Sorting in Warehouse (I)</i> , pp. 53-57.	
Liu, Quan	Beijing Information Science and Technology University
YE, Lingbo	Beijing Information Science and Technology University
09:45-10:15	SaC1A.11
<i>Design and Implementation of Parallel Simulation System for UAV Swarms (I)</i> , pp. 58-63.	
Liu, Moulou	Northwestern Polytechnical University
Chen, Jinchao	Northwestern Polytechnical University
Du, Chenglie	Northwestern Polytechnical University
Yu, Wenquan	North Automatic Control Technology Institute
09:45-10:15	SaC1A.12
<i>Human-Robot Cooperative Motion Constraint Control of Surgical Robot Based on Virtual Fixture (I)</i> , pp. 64-70.	
Zhu, Jiayu	Beihang University
Sun, Zhen	Beihang University
Shen, Yu	Beihang University
Su, Baiquan	Beijing University of Posts and Telecommunications
Qi, Yansong	Inner Mongolia People's Hospital
Wang, Junchen	Beihang University
09:45-10:15	SaC1A.13
<i>Allocation of Multi-UAVs Timing-Dependent Tasks Based on Completion Time (I)</i> , pp. 71-76.	
Chen, Yuheng	Northwestern Polytechnical University
Chen, Jinchao	Northwestern Polytechnical University
Du, Chenglie	Northwestern Polytechnical University
09:45-10:15	SaC1A.14
<i>Adaptive Calibration of the Rotation Error of Total Magnetic Field for AUV Based on Marine Predators Algorithm</i> , pp. 77-83.	
Guo, Chenhang	Hangzhou Dianzi University
Zhang, Xueting	Hangzhou Dianzi University
Wang, Dongrui	Hangzhou Dianzi University
Shen, Caizhen	Hangzhou Dianzi University
Zeng, Fanzong	Hangzhou Dianzi University
09:45-10:15	SaC1A.15
<i>Design of Tire Stevedoring Robot</i> , pp. 84-88.	
Pan, Mengmeng	Beijing Information Science and Technology University
Wu, Siqi	Beijing Information Science and Technology University
Liu, Quan	Beijing Information Science and Technology University

**Sa2A** Room A  
**Medical Robotics** (Invited Sessions)

Chair: Su, Baiquan Beijing University of Posts and Telecommunications

10:15-10:30 Sa2A.1

<i>Cooperative Position and Attitude Following between Master and Slave Continuum Robots (I)</i> , pp. 89-94.	
Su, Baiquan	Beijing University of Posts and Telecommunications
Ma, Xudong	Beijing University of Posts and Telecommunications
Wang, Zehao	Beijing University of Posts and Telecommunications
Gong, Yi	Beijing University of Posts and Telecommunications
Li, Han	Beijing University of Posts and Telecommunications
Yu, Shi	Beijing University of Posts and Telecommunications
Lei, Jingtao	Shanghai University
Kuang, Shaolong	Shenzhen Technology University
Yao, Wei	Peking University Third Hospital

Wang, Junchen	Beihang University
Gao, Yang	Chinese Institute of Electronics
XIU, WEI	Chinese Institute of Electronics
10:30-10:45	Sa2A.2
<i>Two-Stage Multi-Organ Automatic Segmentation with Low GPU Memory Occupancy (I)</i> , pp. 95-100.	
Lv, Yi	Beihang University
Wang, Junchen	Beihang University
10:45-11:00	Sa2A.3
<i>Multi-Functional Neurosurgical Tool with CCD-Imaging, Suction and Electrical Coagulation (I)</i> , pp. 101-106.	
Su, Baiquan	Beijing University of Posts and Telecommunications
Zhang, Yinjia	Beijing University of Posts and Telecommunications
Gong, Yi	Beijing University of Posts and Telecommunications
Tang, Jie	Beijing Tian Tan Hospital, Capital Medical University
Xu, Lixin	Tianjin University of Technology and Education
Li, Han	Beijing University of Posts and Telecommunications
Wang, Zehao	Beijing University of Posts and Telecommunications
Kuang, Shaolong	Shenzhen Technology University
Liu, Wenyong	Beihang University
Lei, Jingtao	Shanghai University
Yao, Wei	Peking University Third Hospital
Wang, Junchen	Beihang University
XIU, WEI	Chinese Institute of Electronics
Gao, Yang	Chinese Institute of Electronics
11:00-11:15	Sa2A.4
<i>Breakthrough Prediction in Robotic Laminectomy Based on Electrical Impedance Monitoring with LSTM-FCN (I)</i> , pp. 107-112.	
Ji, Xuquan	Beihang University
Wang, Yunning	Beihang University
Zhang, Yonghong	Beihang University
Hu, Lei	Beihang University
Li, Kailu	Beihang University
Duan, Wei	Beihang University
Li, Weishi	Peking University Third Hospital
Liu, Wenyong	Beihang University
11:15-11:30	Sa2A.5
<i>A Real-Time Interactive 3D Ultrasound Imaging System (I)</i> , pp. 113-119. <a href="#">Attachment</a>	
Lv, Yifei	Beihang University
Ning, Yu	Beihang University
Shen, Yu	Beihang University
Wang, Junchen	Beihang University
Zhang, Mingbo	First Medical Center, General Hospital of Chinese PLA

<b>Sa2B</b>	Room B
<b>Robot Learning and Control (Invited Sessions)</b>	
Chair: Tao, Yong	Beijing University of Aeronautics and Astronautics
10:15-10:30	Sa2B.1
<i>Optimal Grasping Pose Selection Method for Dual-Arm Robot Based on Improved Genetic Algorithm (I)</i> , pp. 120-126.	
Tao, Yong	Beijing University of Aeronautics and Astronautics
Wan, Jiahao	Beihang University
Liu, Haitao	Beihang University
GAO, HE	Beihang University
Wen, Yufang	Beihang University
10:30-10:45	Sa2B.2
<i>Autonomous Underwater Vehicle (AUV) Based on Oil-Filled Modular Controller (I)</i> , pp. 127-132.	
jiang, xiao	Hangzhou Dianzi University
liu, jingbiao	Hangzhou Dianzi University
Wu, Tongtong	Hangzhou Dianzi University
Huang, Yiliang	Hangzhou Dianzi University

kong, haipeng	HangZhou Electronic Science and Technology University
Shi, Jianguang	Hangzhou Dianzi University
Yu, Haibin	Hangzhou Dianzi University
Peng, Shilin	Hangzhou Dianzi University
10:45-11:00	Sa2B.3
<i>Robot Grasping Using Dilated Residual Convolutional Neural Network (I)</i> , pp. 133-139.	
Zhao, Jing	Wuhan University of Science and Technology
Ye, Liang	Wuhan University of Science and Technology
Wang, Yufeng	Wuhan University of Science and Technology
Min, Huasong	Robotics Institute, Beihang University
11:00-11:15	Sa2B.4
<i>Study of Resin Zipper Defect Detection Algorithm Based on Deep Learning (I)</i> , pp. 140-146.	
Sun, Chuanzhu	Qingdao University
Li, Bin	Qingdao University
Fu, Chaoxing	Qingdao University
11:15-11:30	Sa2B.5
<i>Image Based River Navigation System of Catamaran USV with Image Semantic Segmentation (I)</i> , pp. 147-151.	
Ping, Yang	Westlake University
Song, Changhui	Westlake University
Chen, Linke	Westlake University
Cui, Weicheng	Westlake University
<b>Sa3A</b>	Room A
<b>Bio and Medical Robotics (Regular Sessions)</b>	
Chair: Su, Baiquan	Beijing University of Posts and Telecommunications
13:30-13:45	Sa3A.1
<i>A Localization Method for the Magnetic Levitation Capsule Robot</i> , pp. 152-159.	
Yang, Jiapeng	Beihang University
Wei, Junyi	University of Essex
Wang, Fengwu	Beihang University
Song, Li	Beihang University
Zhao, Jiawei	Beihang University
Feng, Lin	Beihang University
13:45-14:00	Sa3A.2
<i>A Review of Research on Falling Cat Phenomenon and Development of Bio-Falling Cat Robot</i> , pp. 160-165.	
Cao, Jian	Hefei University of Technology
Wang, Shanbo	Hefei University of Technology
Zhu, Xiaocong	Zhejiang University
Song, Lei	Hefei University of Technology
14:00-14:15	Sa3A.3
<i>Immersive Human-Robot Interaction for Dexterous Manipulation in Minimally Invasive Procedures</i> , pp. 166-172.	
<u>Attachment</u>	
Yu, Jiawei	Zhejiang University
Wang, Tengyue	Zhejiang University
Zong, Zhenyu	Zhejiang University
Yang, Liangjing	Zhejiang University
14:15-14:30	Sa3A.4
<i>Model Predictive Control for a Musculoskeletal Robot with Motor Driven Artificial Muscle</i> , pp. 173-178.	
Wan, Weiyang	University of Science and Technology Beijing
Kong, Linghuan	University of Science and Technology Beijing
He, Wei	University of Science and Technology Beijing
14:30-14:45	Sa3A.5
<i>Structure Design and Dimension Optimization of FBG Enhanced Sensitization Equipment for Measuring Axial Tactile Micro-Force of Macular Hole Ophthalmic Surgical Robot</i> , pp. 179-184.	
Li, Mingyang	Xi'an Jiaotong University
Zhang, Xiaodong	Xi'an Jiaotong University
Wang, Ning	Xi'an Jiaotong University

Zhang, Hongbing Feng, Xiaojing	The First Affiliated Hospital of Northwestern University Xi'an Jiaotong University
14:45-15:00	Sa3A.6
<i>Magnetic Manipulation of a Magnetotactic Bacteria-Based Biomicrobot</i> , pp. 185-188.	
Ji, Yiming	Beihang University
Xu, Junjie	Beijing University of Aeronautics and Astronautics
Wang, Luyao	Beihang University
Zhang, Wei	Beihang University
Feng, Lin	Beihang University
<b>Sa3B</b>	Room B
<b>Robot Sensing and Control (Regular Sessions)</b>	
Chair: Yuan, Shuai	Shenyang Jianzhu University
13:30-13:45	Sa3B.1
<i>An IMM-BP Based Algorithm for Tracking Maneuvering Underwater Targets by Multistatic Marine Robot Networks</i> , pp. 189-196.	
Zheng, Feng	Shenyang Institute of Automation, CAS
Tian, Yu	Shenyang Institute of Automation, CAS
Zhan, Weicong	Shenyang Institute of Automation, CAS
Yu, Jiancheng	Shenyang Institute of Automation, CAS
Liu, Kaizhou	Shenyang Institute of Automation, CAS
13:45-14:00	Sa3B.2
<i>A General Framework of Task Understanding for Tour-Guide Robots in Exhibition Environments</i> , pp. 197-202.	
Xi, Xiangming	Zhejiang Lab
Xie, Bing	Zhejiang Lab
Zhu, Shiqiang	Zhejiang Lab
Jin, Tianlei	Zhejiang Lab
ren, jie	Zhejiang Lab
Song, Wei	Zhejiang University
14:00-14:15	Sa3B.3
<i>Tip Motion Control and Vibration Suppression of Flexible Manipulator with Controllable Damping</i> , pp. 203-208.	
Gao, Yingying	Zhejiang University
Zhu, Xiaocong	Zhejiang University
Cao, Jian	Hefei University of Technology
Song, Shuaili	Zhejiang University
14:15-14:30	Sa3B.4
<i>Gaussian Process-Based Adaptive Sliding Mode Tracking Control for Robotic Manipulators</i> , pp. 209-214.	
Li, Tong	University of Science and Technology Beijing
Sun, Liang	University of Science and Technology Beijing
Jiang, Jingjing	Loughborough University
14:30-14:45	Sa3B.5
<i>Equilateral Triangular Formation of Unmanned Surface Vehicles for Target Tracking with Collision Avoidance</i> , pp. 215-220.	
Qian, Guohu	Shanghai Maritime University
Zheng, Xiang	Shanghai Maritime University
Wang, Jianhua	Shanghai Maritime University
Xie, Zhigang	Shanghai Maritime University
Wu, Qiwen	Shanghai Maritime University
Xu, Wei	Shanghai Maritime University
14:45-15:00	Sa3B.6
<i>Multi-Manipulator Motion Planning Based on Gaussian Process with Probabilistic Inference</i> , pp. 221-226.	
wang, wenlong	Beijing University of Chemical Technology
Hu, Biao	Beijing University of Chemical Technology

<b>Sa4A</b>		Room A
<b>Robot Design and Automation (Invited Sessions)</b>		
Chair: Su, Baiquan	Beijing University of Posts and Telecommunications	
15:10-15:25	Sa4A.1	
<i>Mechanism-Data-Based Hybrid Modeling for Denitrification in Urban Wastewater Treatment (I)</i> , pp. 227-233.		
Du, Shengli	Beijing University of Technology	
Zhao, Mingming	Beijing University of Technology	
Zhang, Qingda	Beijing University of Technology	
15:25-15:40	Sa4A.2	
<i>Influences of Predictive Factors on Treatment Effect of Delayed Union with Radial Extracorporeal Shock Wave Therapy</i> , pp. 234-239.		
wang, ziyi	Beihang University	
Li, Chiwei	Beihang University	
Guo, Anyi	Beijing Jishuitan Hospital	
liu, yan	Beihang University	
Liu, Yajun	Beijing Jishuitan Hospital	
Liu, Wenyong	Beihang University	
15:40-15:55	Sa4A.3	
<i>State Estimation of QAUUV Based on Dynamic Model (I)</i> , pp. 240-245.		
ji, Daxiong	Zhejiang University	
Wang, Rui	Zhejiang University	
Wang, Zhi	Zhejiang University	
Ren, Qinyuan	Zhejiang University	
15:55-16:10	Sa4A.4	
<i>Impedance-Based Foot-End Torque Vibration Isolation Control of Parallel Structure Wheel-Legged Robot Attachment</i> , pp. 246-251.		
Xue, Junfeng	Beijing Institute of Technology	
Wang, Shoukun	Beijing Institute of Technology	
Li, Jiehao	Beijing Institute of Technology	
Wang, Junzheng	Beijing Institute of Technology	
Jialong, Zhang	Northwestern Polytechnical University	
Chen, Zhihua	Nanchang Hangkong University, Beijing Institute of Technology	
16:10-16:25	Sa4A.5	
<i>Research on Control of Steel Beam Welding Production Line (I)</i> , pp. 252-256.		
Liu, Bin	Beijing Institute of Technology	
Ma, Mingyang	Beijing Information Science and Technology University	
Huang, Zhengjun	Beijing University of Information Technology	
<b>Sa4B</b>		Room B
<b>Robot Learning (Regular Sessions)</b>		
Chair: Chen, Zhihua	Nanchang Hangkong University, Beijing Institute of Technology	
15:10-15:25	Sa4B.1	
<i>Vehicle Trajectory Prediction for Automated Driving Based on Temporal Convolution Networks</i> , pp. 257-262. <a href="#">Attachment</a>		
Li, Daofei	Zhejiang University	
Li, Houjian	Zhejiang University	
Xiao, Yang	Lotus Technology Ltd	
Li, bo	Lotus Technology Ltd	
Tang, Binbin	Zhejiang University	
15:25-15:40	Sa4B.2	
<i>Similarity Mask Mixed Attention for YOLOv5 Small Ship Detection of Optical Remote Sensing Images</i> , pp. 263-268.		
Zhang, Xiaowen	Shenyang Jianzhu University	
Yuan, Shuai	Shenyang Jianzhu University	
Luan, Fangjun	Shenyang Jianzhu University, School of Information and Control E	
Lv, Jiaqi	Shenyang Jianzhu University	
Liu, Guifu	Shenyang Jianzhu University	



---

15:40-15:55

Sa4B.3

*Personalized Gap Selection Algorithm for On-Ramp Merging Based on Virtual Game*, pp. 269-274.

Xiao, Yang	Lotus Technology Ltd
Li, bo	Lotus Technology Ltd
Xiao, Bin	Zhejiang University
Pan, Hao	Zhejiang University
Lyu, Hao	Lotus Technology Ltd
Li, Daofei	Zhejiang University

---

15:55-16:10

Sa4B.4

*Deep Learning Assisted Automated Separation Platform of Single Cells and Microparticles Using Optoelectronic Tweezers*, pp. 275-279.

Zhao, Jiawei	Beihang University
Gan, Chunyuan	Beihang University
Zhang, Jiaying	Beihang University
Liang, Shuzhang	Beihang University
Yang, Jiapeng	Beihang University
Feng, Lin	Beihang University

---

16:10-16:25

Sa4B.5

*Research on UAV Online Visual Tracking Algorithm Based on YOLOv5 and FlowNet2 for Apple Yield Inspection*, pp. 280-285.

Wang, ShaoPeng	Xi'an Jiaotong University
Zhang, Xiaodong	Xi'an Jiaotong University
shen, haiming	Xi'an Jiaotong University
Tian, Minxuan	Xi'an Jiaotong University
Li, Mingyang	Xi'an Jiaotong University