第五届国际自主系统大会

The 5th International Symposium on Autonomous Systems, ISAS 2022

Program

April 8-10, Hangzhou, China

Hosts

Hangzhou Innovation Institute, Beihang University
Chongqing University

The symposium is technically supported by IEEE

程序册（FINAL PROGRAM）

第五届国际自主系统大会

The 5th International Symposium on Autonomous Systems, ISAS 2022

2022 年 4 月 8 日至 4 月 10 日，杭州，中国

April 8-10, 2022, Hangzhou, China

主办单位（Hosts）

北京航空航天大学杭州创新研究院

- Hangzhou Innovation Institute, Beihang University

重庆大学

- Chongqing University

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欢迎辞（**Welcome Address**）

On behalf of the ISAS 2022 Conference Organizing Committee, we are very pleased to welcome you to Hangzhou, China for the 2022 IEEE International Symposium on Autonomous Systems. Due to the pandemic of COVID-19 worldwide, the Symposium structure is modified to account for both physical presence and virtual presence originally.

This Symposium was initiated by the Key Lab of Autonomous Systems and Networked Control in the South China University of Technology, the Advanced Controls and Sensors Group of University of Texas at Arlington, and it was first held in South China University of Technology in June 5, 2017. After the second Symposium held in Chongqing University and the third in Shanghai Jiao Tong University, the fourth ISAS came back to South China University of Technology again. This year, Hangzhou Innovation Institute of Beihang University is honored to be given the opportunity to hold the fifth ISAS. We should mention that the ISAS 2022 Program Committee worked extremely hard to review the paper submissions in order to maintain the quality of the conference.

ISAS 2022 is highlighted by four Plenary Lectures and six Invited Lectures. We are indeed very honored to have these four world-renowned researchers to present these Plenary Lectures. Dr. Weimin Bao, Member of the Chinese Academy of Sciences, will present a speech on "Intelligent Control Techniques Enable Autonomous Learning in Rockets", Professor Roland Siegwart, Member of the Swiss Academy of Engineering Sciences, ETH Zurich, Switzerland, will present a speech on "Pioneering Flying Robots", Professor Qing-Long Han, Member of the Academia Europaea, Swinburne University of Technology, Australia, will present a speech on "Recent Advances in Coordinated Control of Multiple Autonomous Surface Vehicles", Professor Yang Shi，Fellow of Engineering Institute of Canada，University of Victoria, Canada, will present a speech on "Advanced Model Predictive Control (MPC) Framework for Autonomous Intelligent Systems". We are sure we will be able to gain useful ideas and experiences from them.

We wish to express our appreciation and thanks to all the individuals who have contributed to ISAS 2022 in a variety of ways. Special thanks are extended to our colleagues in the Program Committee for their thorough review of all the submitted papers, which is vital to this Symposium. We must also extend our thanks to all the members of the Organizing Committee and our volunteer students who have dedicated their time and efforts to help the conference. Last but not least, our special thanks go to distinguished plenary speakers, keynote speakers and all the authors for contributing their research work, and to the participants in making the ISAS 2022 a great event. Thank you and wish you all a great conference experience.

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大会报告（**Plenary Lectures**）

Plenary Lecture 1

Intelligent Control Techniques Enable Autonomous Learning in Rockets

智能控制技术让火箭"会学习"

包为民（**Weimin Bao**）

Science and Technology Commission of China Aerospace Science and Technology
Corporation, China
Chair: Huaining Wu (Beihang University, China)

Saturday, April 9, 9:00-9:50
Tencent Meeting: 770 6693 9666

摘要（Abstract）：

　　中国航天的快速发展，运载火箭技术发挥着卓越的支撑作用，对航天事业从无到有、从弱到强形成了极大的促进和推动。当前，我国正在航天强国建设的新阶段，控制技术随着新科技革命的深化呈现出新的特征和态势，如何发展航天智能控制技术，打造"会学习"的火箭，助力航天工程，报告分析了航天控制技术的发展和实践历程，介绍了航天智能控制技术助力运载火箭发展的思路，探讨展望了航天控制技术的未来发展。

简历（Biography）：

　　　　包为民，男，中国科学院院士、国际宇航科学院院士。现任中国航天科技集团科技委主任，兼任第十届中国科协副主席，全国政协第十一、十二、十三届委员，中国科学院主席团成员，国际宇航科学院主席团成员、工程学部主席，中国惯性学会理事长，西安电子科大空间学院院长。作为我国航天运载器总体及控制系统领域的学术带头人，曾领导和参与我国多项重大工程研制，他将理论知识和实践工作相结合，为我国国防工业现代化建设解决了一系列技术难题。获得国家科技进步特等奖 1 项、国家技术发明一等奖 1 项、国家科技进步一等奖 1 项。

Pioneering Flying Robots

Roland Siegwart

Autonomous Systems Lab & Wyss Zurich, Switzerland
Chair: Youmin Zhang (Concordia University, Canada)

Saturday, April 9, 14:00-14:50
Tencent Meeting: 770 6693 9666
Zoom Meeting: 212 213 6272 (Password: 123456)

摘要（Abstract）：

For fast search & rescue or inspection of complex environments, flying robots are probably the most efficient and versatile devices. However, the limited flight time and payload, as well as the restricted computing power of drones renders autonomous operations quite challenging. This talk will focus on the design and autonomous navigation of flying robots. Innovative designs of flying systems, from novel concepts of omni-directional multi-copters to solar airplanes for continuous flights are presented. Recent results of visual and laser based navigation (localization, mapping, planning) in GPS denied environments are showcased and discussed. Performance and potential applications are presented.

简历（Biography）：

Roland Siegwart (born in 1959) is professor for autonomous mobile robots at ETH Zurich, founding co-director of the Wyss Zurich and member of the board of directors of multiple high-tech companies. He studied mechanical engineering at ETH, brought up a spin-off company, spent ten years as professor at EPFL Lausanne (1996 – 2006), was vice president of ETH Zurich (2010 -2014) and held visiting positions at Stanford University and NASA Ames. He is and was the coordinator of multiple European projects and co-founder of half a dozen spin-off companies. He is IEEE Fellow and recipient of the IEEE RAS Pioneer award and the IEEE RAS Inaba Technical Award. He is on the editorial board of multiple journals in robotics and was a general chair of several conferences in robotics including IROS 2002, AIM 2007, FSR 2007, ISRR 2009, FSR 2017 and CoRL 2018. His interests are in the design and navigation of wheeled, walking and flying robots operating in complex and highly dynamical environments. Hi is a strong promotor of innovation and entrepreneurship.

Sunday, April 10, 9:00-9:50
Tencent Meeting: 770 6693 9666

摘要（**Abstract**）：

More than 70% of earth surface is covered by oceans, and ocean space contains a vast chamber of natural resources including oil and gas, biological species, mineral products. The ocean becomes a strategic space and resource base for the survival of human beings and sustainable development of society. In order to explore and utilize these resources, there is a surge of interest in the development and deployment of autonomous surface vehicles (ASVs) to sample, uncover, explore, study, and protect the oceans. ASVs provide unique capabilities for performing various missions in complex sea environments without risking human lives. For complex missions, there are increasing needs for deploying a fleet of ASVs instead of a single one to complete difficult tasks. Cooperative operations with a fleet of ASVs offer great advantages with enhanced capability and efficacy. Despite various application potentials, coordinated motion control of ASVs faces great challenges due to the nonlinearities, uncertainties, disturbances induced by winds, waves, and ocean current, under-actuation properties, scarce communication bandwidths in the sea environment, and collision avoidance requirements. Therefore, it is essential and critical to develop sophisticated coordinated guidance and control techniques for cooperative maneuvering of multiple ASVs.

This plenary talk aims to provide recent advances in coordinated control of multiple ASVs. First, the background on coordinated control of multi-ASV systems are briefly introduced. Second, some challenging issues and scenarios in motion control of ASVs are presented. Third, recent results on trajectory-guided, path-guided, and target-guided coordinated control of multiple ASVs are reviewed in detail. Fourth, coordinated target enclosing of multiple ASVs with experiments is presented. Finally, several theoretical and technical issues are suggested to direct future investigations.

简历（**Biography**）：

Professor Han is Pro Vice-Chancellor (Research Quality) and a Distinguished Professor at Swinburne University of Technology, Melbourne, Australia. He held various academic and management positions at Griffith University and Central Queensland University, Australia. He received the Ph.D. degree in Control Engineering from East China University of Science and Technology in 1997.

Professor Han has been conducting research in the areas of networked control systems, cyber physical systems, time-delay systems, multi-agent systems, smart grids, offshore structure, unmanned surface vehicles, cyber security, and neural networks. Since 2001, as of 8 August 2021, he has authored or co-authored three hundred and thirty-eight (338) fully-refereed high quality journal articles including one hundred and seventy-five (175) articles in the most prestigious IEEE Transactions, and thirty-seven (37) articles in Automatica. He has also authored or co-authored one hundred and eighty-four (184) international leading conference papers, five (5) monographs, one (1) research-based book chapter, and edited four (4) conference proceedings and ten (10) special issues. His research work has been cited 32,811 times with an h-index of 102, an i10-index of 296 according to Google Scholar, and 23,600 times with an h-index of 88 according to Clarivate Analytics Web of Science Core Collection.

Professor Han is a Highly Cited Researcher in the Essential Science Indicator (ESI) field of Engineering (2014-2017), in the ESI Cross-Field (2018) and in both the ESI fields of Engineering and Computer Science (2019-2020) by Clarivate Analytics (Thomson Reuters). He is one of Australia's Top 5 Lifetime Achievers (Research Superstars) in the discipline area of Engineering and Computer Science by The Australian's Research Magazine (2019-2020). He is one of Australia's Top 5 Researchers in Computer Science and Electronics by Guide2Research.

Professor Han was the recipient of The 2021 M. A. Sargent Medal (the Highest Award of the Electrical College Board of Engineers Australia), The 2020 IEEE Systems, Man, and Cybernetics (SMC) Society Andrew P. Sage Best Transactions Paper Award, The 2020 IEEE Transactions on Industrial Informatics Outstanding Paper Award, and The 2019 IEEE SMC Society Andrew P. Sage Best Transactions Paper Award. He was the recipient of The 2020 IEEE SMC Society Best Associate Editor Award and The 2020 IEEE/CAA Journal of Automatica Sinica Outstanding Associate Editor Award.

Professor Han is a Member of the Academia Europaea (The Academy of Europe). He is a Fellow of The Institute of Electrical and Electronic Engineers (IEEE) and a Fellow of The Institution of Engineers Australia. He has served as an AdCom Member

of IEEE Industrial Electronics Society (IES), a Member of IEEE IES Fellows Committee, and Chair of IEEE IES Technical Committee on Network-based Control Systems. He has served as Co-Editor-in-Chief IEEE Transactions on Industrial Informatics (2022-2024), Co-Editor of Australian Journal of Electrical & Electronics Engineering, an Associate Editor for 12 international journals including IEEE Transactions on Cybernetics, IEEE Industrial Electronics Magazine, IEEE/CAA Journal of Automatica Sinica, Control Engineering Practice，Information Sciences, and a Guest Editor for 13 Special Issues.

Plenary Lecture 4

Advanced Model Predictive Control (MPC) Framework for Autonomous Intelligent Systems

Yang Shi

University of Victoria, Canada
Chair: Youmin Zhang (Concordia University, Canada)

Sunday, April 10, 9:50-10:40
Tencent Meeting: 770 6693 9666

摘要（Abstract）：

Autonomous intelligent systems, which lie at the intersection of unmanned systems, robotics, systems and control, multi-agent systems, networked and distributed systems, machine learning, etc. Autonomous intelligent systems are equipped with abilities such as sensing and perception, data processing and information fusion, intelligent decision making, autonomous control, learning and adaption, communications and computation, thus can achieve a high level of autonomy to perform missions without human intervention or can naturally interact and collaborate with humans and/or environment. The fundamental control theory and methods in autonomous intelligent systems are of central importance in orchestrating all related functions. Autonomous control and intelligence can be applied to various systems, e.g., aerial vehicles, marine vehicles, ground robots, space exploration, energy and power systems, transportation and smart city, intelligent agriculture, smart manufacturing, smart health care systems, Internet of Things, etc. **Model predictive control (MPC)** is a promising paradigm for high-performance and cost-effective control of autonomous intelligent system. This talk will firstly summarize the major application requirements and challenges to innovate in designing, implementing, deploying and operating autonomous intelligent system. Further, the robust MPC and distributed MPC design framework will be presented. Finally, the application of MPC algorithms to various autonomous intelligent systems will be illustrated.

简历（**Biography**）：

Yang Shi received his B.Sc. and Ph.D. degrees in mechanical engineering and automatic control from Northwestern Polytechnical University, Xi'an, China, in 1994 and 1998, respectively, and the Ph.D. degree in electrical and computer engineering from the University of Alberta, Edmonton, AB, Canada, in 2005. From 2005 to 2009, he was an Assistant Professor and Associate Professor in the Department of Mechanical Engineering, University of Saskatchewan, Saskatoon, SK, Canada. In 2009, he joined the University of Victoria, and now he is a Professor in the Department of Mechanical Engineering, University of Victoria, Victoria, BC, Canada. His current research interests include networked and distributed systems, model predictive control (MPC), cyber-physical systems (CPS), robotics and mechatronics, navigation and control of autonomous systems (AUV and UAV), and energy system applications.

Dr. Shi received the University of Saskatchewan Student Union Teaching Excellence Award in 2007, and the Faculty of Engineering Teaching Excellence Award in 2012 at the University of Victoria (UVic). He is the recipient of the JSPS Invitation Fellowship (short-term) in 2013, the UVic Craigdarroch Silver Medal for Excellence in Research in 2015, the 2017 IEEE Transactions on Fuzzy Systems Outstanding Paper Award, the Humboldt Research Fellowship for Experienced Researchers in 2018. He is a member of the IEEE Industrial Electronics Society (IES) Administrative Committee and the IES Fellow Evaluation Committee during 2017-2019. He is currently a Vice-President of IEEE IES, the Chair of IEEE IES Technical Committee on Industrial Cyber-Physical Systems, and a Co-Editor-in-Chief for IEEE Transactions on Industrial Electronics. He also serves as Associate Editor for Automatica, IEEE Transactions on Cybernetics, etc. He is General Chair of the 2019 International Symposium on Industrial Electronics (ISIE) and the 2021 International Conference on Industrial Cyber-Physical Systems (ICPS).

He is a Fellow of IEEE, ASME, CSME, and Engineering Institute of Canada (EIC), and a registered Professional Engineer in British Columbia, Canada.

特邀报告（Invited Lectures）

Invited Lecture 1

Fault Diagnosis and Self-healing Control Technology of Aerospace Vehicles

空天飞行器的故障诊断与自愈合控制技术

姜斌（Bin Jiang）

Nanjing University of Aeronautics and Astronautics, China
Chair: Huaining Wu (Beihang University, China)

<div align="right">

Saturday, April 9, 10:00-10:30
Tencent Meeting: 770 6693 9666

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摘要（Abstract）：

　　空天飞行器具有飞行环境多变、控制精度要求高、跟踪要求快速和大范围高速机动的特点，其飞行器构型和参数变化范围大，对故障补偿能力要求高。执行器是性能关键系统中重要的元部件，一旦发生故障，系统的结构将会发生不确定的变化，设计的控制信号将无法对系统产生有效的影响，从而造成系统性能的损失，甚至出现失控的情况。因此，空天飞行器的自愈合控制面临着大量亟待解决的难题。针对高超声速飞行器执行器故障及结构损伤故障，考虑飞行过程中受到的干扰，研究干扰下的故障诊断与自愈合控制方法与技术，基于仿真平台开展了空天飞行器纵向系统的故障诊断与自愈合控制技术应用研究。

简历（Biography）：

　　姜斌，南京航空航天大学教授、副校长，IEEE Fellow，教育部"长江学者"特聘教授，中国自动化学会会士。担任IEEE 南京分部控制系统分会主席、Int. J. Control, Automation and Systems 期刊领域主编，IEEE Trans. on Cybernetics、《宇航学报》等期刊编委，中国自动化学会技术过程故障诊断与安全性专业委员会副主任，中国航空学会导航、制导与控制分会副主任。从事智能诊断和容错控制及其在飞控和高铁牵引系统中的应用研究,主持获得国家自然科学二等奖、江苏省科技一等奖等奖励；获得授权发明专利 28 项，出版学术专著 8 部。

Invited Lecture 2

Unmanned Aerial Vehicle Systems: From Sense & Avoid to Autonomous Safety

无人机系统，从感知规避到自主安全

潘泉（Quan Pan）

Northwestern Polytechnical University, China
Chair: Qinglei Hu (Beihang University, China)

摘要（Abstract）：

　　无人机的应用从中高空/大中型无人机，迅速拓展到中低空/中小型无人机，飞行环境从开阔单一的野外环境，逐步向未知的、密集的、高动态的城市、山地、丛林等中低空复杂环境转变，无人机与环境耦合交互的程度更深。同时，无人机的任务日趋多元复合，无人机进入更多的行业领域，应用领域正在不断扩展。飞行空域、应用环境和承担任务的变化，给无人机安全带来新的严峻挑战，其安全威胁已经超出传统无人机安全飞行范畴。报告从感知规避概念模型技术展开，构建可量化、可验证的无人机系统自主安全模型、安全架构，梳理相应的技术体系，提出无人机自主安全概念和体系，探讨无人机系统自主安全保障机制，以推动无人机更加安全地拓展到人与环境深度耦合的应用领域，保障无人机行业的健康发展，也为其他无人系统（无人车、无人船、无人艇等）安全体系研究提供借鉴。

简历（Biography）：

　　潘泉，西北工业大学自动化学院、网络空间安全学院（国家保密学院）教授，信息融合技术教育部重点实验室主任、智能装备系统安全控制陕西省工程研究中心主任。研究方向：信息融合、目标跟踪与识别、无人机探测导航与安全控制。获国家科技进步一、三等奖各 1 项，省部级科技进步奖 15 项。出版专著 15 部，发表论文 600 余篇，授权发明专利 70 余项。获全国优秀科技工作者、中国青年科技奖、陕西省有突出贡献专家、陕西省优秀教师。任中国自动化学会会士，中国指挥与控制学会常务理事，军科委 XX 信息技术领域专家，装发 XX 技术专业组专家，中国自动化学会无人飞行器自主控制专委会、制造系统专委会副主任，中国航空学会信息融合专委会、机载武器试验与鉴定专委会副主任等。

Invited Lecture 3

Key Technologies for Unmanned Autonomous Systems with Variable Structure

变结构无人自主系统关键技术

鲁仁全（**Renquan Lu**）

Guangdong University of Technology, China
Chair: Zhenqiang Qi (China Academy of Launch Vehicle Technology, China)

Saturday, April 9, 15:00-15:30
Tencent Meeting: 770 6693 9666

摘要（Abstract）：

针对水陆空跨域特殊场景，研究了在机构突变，环境巨变，拓扑时变情况下的无人自主系统姿态控制，减振控制，协同控制等变结构控制理论，研发了具有变结构特种功能的无人自主系统，研制了水空两栖无人机，陆空两栖无人机，十六旋翼载人无人机等多种无人自主载体，突破了伺服电机等关键技术。

简历（Biography）：

鲁仁全，广东工业大学智能决策与协同控制研究所所长，研究所共有 24 名长期研究者，200 名硕士博士与博士后。研究所主要从事针对特殊场景下的变结构无人自主系统协同控制研究，已经建立了从设计、零部件加工、系统集成到装配的完全自主产权的无人车和无人机生产线。研制了变结构载人 12 旋翼无人机，变结构水陆两栖无人车，水空两栖变结构无人机，空地两栖无人机等四类核心产品，130 余种各类无人自主系统，自主研发的无人驾驶系统，自主开发的飞控系统已经实现了产业化；研发的伺服与减震一体化电机已经应用在自主研制的大狗上，具备了产业化前景，能广泛应用于工业机器人的机械臂控制；研发的陆空两栖无人机已经应用在电网导线巡检。现为广东工业大学自动化学院特聘教授，计算机与应用学科带头人，博导，长江学者特聘教授、万人计划领军人才，国家杰出青年基金项目获得者、科技部重点领域创新团队带头人、科技部创新人才培养基地负责人、广东省自然科学基金研究团队带头人、广东省重点实验室主任、享受国务院特殊津贴、珠江学者特聘教授、国家百千万人才工程有突出贡献中青年专家、教育部新世纪优秀人才计划获得者，担任中国自动化学会控制理论专业委员会（TCCT）委员。获得国家自然科学基金杰出青年基金 1 项、主持 863 项目 2 项、主持 NSFC-广东大数据科学中心项目 1 项（重点支持项目）、科技部重点领域创新团队项目 1 项、国家重点研发计划 1 项、中央财政支持地方

高校改革发展资金人才培养和创新团队建设项目 1 项，广东省科技创新战略专项资金项目 1 项。荣获教育部自然科学一等奖（两项）、广东省科技进步一等奖、浙江省科学技术奖一等奖、教育部科学技术进步奖二等奖、中国纺织工业协会科学技术进步奖二等奖等奖励。

至今为止，发表 SCI 论文 140 余篇，包括 Automatica 论文 9 篇，IEEE 汇刊论文 60 余篇，SCI 他引 3700 余次，高被引论文 27 篇，出版专著 3 部，授权发明专利近 30 项，申请发明专利 60 余项。

Invited Lecture 4

Small-sample Machine Learning for Intelligent Sensing and Optimal Control of Robots

机器人智能感知与优化控制的小样本机器学习

徐昕（Xin Xu）

National University of Defense Technology, China
Chair: Zhenqiang Qi (China Academy of Launch Vehicle Technology, China)

Saturday, April 9, 15:30-16:00
Tencent Meeting: 770 6693 9666

摘要（Abstract）：

　　随着工业、医疗、国防等领域对各类机器人和无人系统应用需求的增加，需要研究和探索复杂不确定环境中机器人系统智能感知与优化控制的小样本机器学习理论和方法，减少对人工标记样本或者实际交互数据的依赖。报告在分析相关技术需求的基础上，介绍了机器人目标识别的鲁棒半监督学习、正则化强化学习、在线学习预测控制、迁移强化学习的研究进展，以及在智能无人车辆自主控制中应用的若干研究进展。最后对进一步的工作进行了分析和展望。

简历（Biography）：

　　徐昕，国防科技大学教授，博士生导师。国家杰出青年科学基金获得者。主要从事智能无人系统的自主控制与机器学习等方面研究，获国家自然科学二等奖 1 项、湖南省自然科学一等奖 2 项，作为学术带头人之一（排名 3）获湖南省科技创新团队奖 1 项。主持国家自然科学基金重点项目 2 项、国家重点研发计划项目课题、973 项目课题、装备预研项目等 20 余项。任中国自动化学会自适应动态规划与强化学习专业委员会副主任、平行控制与管理专业委员会副主任、机器人智能专业委员会顾问委员，中国指挥与控制学会无人系统专业委员会副主任。出版专著 2 部，发表 SCI 论文 100 余篇，代表性论文发表在 IEEE TNNLS, J. AI Research, J of Filed Robotics, IEEE TSMC: Systems, IEEE TPAMI, IEEE TCST, IEEE TITS 等期刊。任 IEEE Transactions on SMC: Systems, Information Sciences, International Journal of Robotics and Automation、IET Cyber-systems and Robotics、Intelligence and Robotics 等国际期刊的 Associate Editor，CAAI Transactions on Intelligence Technology 副主编以及《控制理论与应用》编委。

Spacecraft Autonomous Operation Technology Based on Capability Quantitative Evaluation

基于能力量化评价的航天器自主运行技术

王大轶（Dayi Wang）

China Academy of Space Technology, China
Chair: Xiang Yu (Beihang University, China)

Sunday, April 10, 10:50-11:20
Tencent Meeting: 770 6693 9666

摘要（Abstract）：

历经几十年的技术发展，航天器已经基本实现了自动化；本世纪初，探月工程等深空探测任务的开展对航天器自主运行技术提出了更加迫切的需求。报告人针对航天器这类资源严重受限、不易在轨维护的空间无人系统，提出了基于能力量化评价的自主运行技术：以系统能力的定性判定和定量表达为突破口，通过构建可观测性、可诊断性与可重构性理论，从根本上突破了制约航天器自主运行技术发展的两大核心难点——自主导航与自主诊断重构，使航天器在占用最低星上资源和无需任何人造信标的条件下实现安全稳定自主运行。本报告介绍了上述理论方法及其在具体航天器型号中的应用情况，并对未来可能的发展方向进行了总结和展望。

简历（Biography）：

王大轶，研究员，博士生导师，1973 年 11 月出生，北京空间飞行器总体设计部科技委主任；国家杰出青年科学基金获得者，国防科技卓越青年科学基金（首届）获得者，国家万人计划科技创新领军人才，973 项目技术首席；2015 年获中国科协求是杰出青年奖，2016 年获何梁何利基金科学与技术创新奖，2017 年入选国家级百千万人才工程，享受国务院政府特殊津贴，是国家有突出贡献的中青年专家。他长期致力于突破航天器自主运行两大核心问题（自主导航和自主诊断重构）的研究工作，取得了系列创新性成果，并成功应用于对自主运行需求最为迫切的嫦娥工程等任务，为实现航天器安全可靠自主运行做出了重要贡献。

Invited Lecture 6

High-Precision Navigation Technology and Research Progress in GPS-Denied Environments

拒止环境下的高精度导航技术及研究进展

陈熙源 (Xiyuan Chen)

Southeast University, China
Chair: Xiang Yu (Beihang University, China)

Sunday, April 10, 11:20-11:50
Tencent Meeting: 770 6693 9666

摘要（Abstract）：

卫星拒止环境下的高精度导航技术是导航领域的难题之一，在海陆空天等军事领域和智能驾驶等民用领域都具有广阔的应用前景。卫星信号在复杂场景下的接收性能给高精度导航定位带来了挑战。本报告主要针对卫星信号拒止环境下的高精度单一导航、松组合导航、紧组合导航、深耦合导航技术及其发展应用进行介绍和综述，对载体弹性 PNT 融合导航方法、融合架构和重构框架等进行分析和探讨，以水面水下载体在水面和水下导航为例进行应用演示验证，并对未来的可能发展方向进行概述。

简历（Biography）：

陈熙源，男，博士，东南大学二级教授、博士生导师。中国仪器仪表学会、中国海洋工程咨询协会、中国造船工程学会理事，中国造船工程学会船舶仪器仪表学委会副理事长，江苏省研究生工学一类教学指导委员会委员，江苏省仪器仪表学会秘书长。

主要研究惯性技术和组合导航，理论与实践并重，承担了国家自然科学基金、973、国家重点研发计划、装备预研等多项课题，研发了多型惯性导航和组合导航系统并在军民领域大规模应用。以第一和通讯作者在 IEEE TAES 和 IEEE TSP 等汇刊以及 MSSP 等国际知名期刊发表 SCI 论文 80 余篇，授权发明专利 98 项(其中美国发明专利 2 项)，国际 PCT 专利 11 项。

研究成果获得国际日内瓦发明专利金奖（2021）、中国船舶重工集团一等奖（2020）、教育部技术发明二等奖（2017）、江苏省科学技术二等奖（2019）、中国专利优秀奖（2017）、国际日内瓦发明专利铜奖（2015）、中国产学研合作创新奖（2015）等奖励和荣誉。

会议程序总览（**Program at a Glance**）

4 月 9 日（星期六）/ April 9（Saturday）			
大会报告/ Plenary Lectures、特邀报告/ Invited Lectures, 腾讯会议/ Tencent Meeting: 770 6693 9666			
8:30-9:00	开幕式/Opening Ceremony: Addresses by: Profs. Frank Lewis, Tianyou Chai, Huijun Gao, Yuan Deng, Lei Guo, Yongduan Song		Chair: Youmin Zhang
9:00-9:50	大会报告 1/Plenary Lecture 1: 智能控制技术让火箭"会学习"，Dr. Weimin Bao		Chair: Huaining Wu
9:50-10:00	中场休息/ Break		
10:00-10:30	特邀报告 1/Invited Lecture 1: 空天飞行器的故障诊断与自愈合控制技术, Prof. Bin Jiang		Chair: Huaining Wu
10:30-11:00	特邀报告 2/Invited Lecture 2: 无人机系统，从感知规避到自主安全, Prof. Quan Pan		Chair: Qinglei Hu
11:00-14:00	中场休息/ Break		
14:00-14:50	大会报告 2/Plenary Lecture 2: Pioneering Flying Robots, Prof. Dr. Roland Siegwart Zoom Meeting: 212 213 6272 (Password: 123456)		Chair: Youmin Zhang
14:50-15:00	中场休息/ Break		
15:00-15:30	特邀报告 3/Invited Lecture 3: 变结构无人自主系统关键技术, Prof. Renquan Lu		Chair: Zhenqiang Qi
15:30-16:00	特邀报告 4/Invited Lecture 4: 机器人智能感知与优化控制的小样本机器学习, Prof. Xin Xu		Chair: Zhenqiang Qi

分会场报告/ Oral Sessions, 腾讯会议/ Tencent Meeting			
Time/Room	**会场1/Room 1**	**会场2/Room 2**	**会场 3/Room 3**	**会场 4/Room 4**
13:30-14:50	**Sat-1.1:** Artificial Intelligence **Conference Number:** 847 235 137	**Sat-2.1:** Autonomous Systems **Conference Number:** 360 601 270	**Sat-3.1:** Autonomous Systems and Intelligent Control **Conference Number:** 583 478 201	**Sat-4.1:** Invariant Kalman Filtering and Multi-Sensor Fusion **Conference Number:** 714 415 276
14:50-15:10	中场休息/ Break			
15:10-17:30	**Sat-1.2:** Multi-Sensors in Polar Navigation and Integrity monitoring **Conference Number:** 362 165 172	**Sat-2.2:** Autonomous Systems **Conference Number:** 211 628 919	**Sat-3.2:** Intelligent Control and Automation **Conference Number:** 294 791 019	**Sat-4.2:** Modeling and Optimal Control for Networked Systems **Conference Number:** 671 753 256

4 月 10 日（星期日）/ April 10（Sunday）				
大会报告/ Plenary Lectures、特邀报告/ Invited Lectures, 腾讯会议/ Tencent Meeting: 770 6693 9666				
9:00-9:50	大会报告 3/Plenary Lecture 3: Recent Advances in Coordinated Control of Multiple Autonomous Surface Vehicles, Prof. Qing-Long Han			Chair: Youmin Zhang
9:50-10:40	大会报告 4/Plenary Lecture 4: Advanced Model Predictive Control (MPC) Framework for Autonomous Intelligent Systems, Prof. Yang Shi			Chair: Youmin Zhang
10:40-10:50	中场休息/ Break			
10:50-11:20	特邀报告 5/Invited Lecture 5: 基于能力量化评价的航天器自主运行技术, Prof. Dayi Wang			Chair: Xiang Yu
11:20-11:50	特邀报告 6/Invited Lecture 6: 拒止环境下的高精度导航技术及研究进展, Prof. Xiyuan Chen			Chair: Xiang Yu
11:50-12:20	闭幕式/Closing Ceremony			Chair: Youmin Zhang
分会场报告/ Oral Sessions, 腾讯会议/ Tencent Meeting				
Time/Room	会场1/Room 1	会场 2/Room 2	会场 3/Room 3	会场4/Room 4
8:30-9:50	**Sun-1.1:** Artificial Intelligence **Conference Number:** 997 505 864	**Sun-2.1:** Robotics and Networked Control Systems **Conference Number:** 723 287 041	**Sun-3.1:** Autonomous Systems **Conference Number:** 517 642 459	**Sun-4.1:** Fault Diagnosis and Resource-Efficient Control **Conference Number:** 184 325 984
9:50-10:10	中场休息/ Break			
10:10-11:50	**Sun-1.2:** Advanced Control Theory and its Applications in UAVs **Conference Number:** 416 600 092	**Sun-2.2:** Fault-Tolerant Control for Unmanned Systems **Conference Number:** 487 400 180	**Sun-3.2:** Reliability Analysis and Fault Prognostics **Conference Number:** 989 985 479	**Sun-4.2:** Fault Diagnosis and Fault-Tolerant Control **Conference Number:** 407 803 295
11:50-13:30	中场休息/ Break			
13:30-14:50	**Sun-1.3:** Autonomous Systems **Conference Number:** 545 296 742	**Sun-2.3:** Automation **Conference Number:** 139 489 429	**Sun-3.3:** Cooperative Guidance, Navigation, and Control (GNC) **Conference Number:** 448 354 124	**Sun-4.3:** Sensing, Control and Security of Robotic Systems **Conference Number:** 408 729 027
14:50-15:10	中场休息/ Break			
15:10-16:50	**Sun-1.4:** Autonomous Systems and Emerging Technologies **Conference Number:** 470 454 718	**Sun-2.4:** Intelligent Control and Emerging Technologies **Conference Number:** 676 182 475	**Sun-3.4:** Cooperative Guidance, Navigation, and Control (GNC) **Conference Number:** 320 200 606	**Sun-4.4:** Distributed Estimation in Sensor Network **Conference Number:** 123 925 090

学术报告（**Technical Program**）

大会报告（**Plenary Lectures**）、特邀报告（**Invited Lectures**）

4 月 9 日（星期六）/ April 9（Saturday）

上午/Morning 8:30-11:00		
开幕式/**Opening Ceremony**	**8:30-9:00**	主会场/**Main Room**
Chair: Youmin Zhang		Concordia University
大会报告1/**Plenary Lecture 1**	**9:00-9:50**	主会场/**Main Room, 2 楼/2ᵗʰ Floor**
智能控制技术让火箭"会学习"		
Speaker: Weimin Bao	China Aerospace Science and Technology Corporation, China	
Chair: Huaining Wu		Beihang University
中场休息/**Break 9:50-10:00**		
特邀报告 1/**Invited Lecture 1**	**10:00-10:30**	主会场/**Main Room**
空天飞行器的故障诊断与自愈合控制技术		
Speaker: Bin Jiang	Nanjing University of Aeronautics and Astronautics, China	
Chair: Huaining Wu		Beihang University
特邀报告 2/**Invited Lecture 2**	**10:30-11:00**	主会场/**Main Room**
无人机系统，从感知规避到自主安全		
Speaker: Quan Pan	Northwestern Polytechnical University, China	
Chair: Qinglei Hu		Beihang University
下午/Afternoon 14:00-16:00		
大会报告2/**Plenary Lecture 2**	**14:00-14:50**	主会场/**Main Room**
Pioneering Flying Robots		
Speaker: Roland Siegwart		ETH Zurich, Switzerland
Chair: Youmin Zhang		Concordia University
中场休息/**Break 14:50-15:00**		
特邀报告 3/**Invited Lecture 3**	**15:00-15:30**	主会场/**Main Room**
变结构无人自主系统关键技术		
Speaker: Renquan Lu	Guangdong University of Technology, China	
Chair: Zhenqiang Qi	China Academy of Launch Vehicle Technology	
特邀报告 4/**Invited Lecture 4**	**15:30-16:00**	主会场/**Main Room**
机器人智能感知与优化控制的小样本机器学习		
Speaker: Xin Xu	National University of Defense Technology, China	
Chair: Zhenqiang Qi	China Academy of Launch Vehicle Technology	

4 月 10 日（星期日）/ April 19（Sunday）

上午/Morning　9:00-12:20		
大会报告3/Plenary Lecture 3	9:00-9:50	主会场/Main Room
Recent Advances in Coordinated Control of Multiple Autonomous Surface Vehicles **Speaker:** Qing-Long Han　　　　Swinburne University of Technology, Australia **Chair:** Youmin Zhang　　　　Concordia University		
大会报告 4/Plenary Lecture 4	9:50-10:40	主会场/Main Room
Advanced Model Predictive Control (MPC) Framework for Autonomous Intelligent Systems **Speaker:** Yang Shi　　　　University of Victoria, Canada **Chair:** Youmin Zhang　　　　Concordia University		
中场休息/Break 10:40-10:50		
特邀报告 5/Invited Lecture 5	10:50-11:20	主会场/Main Room
基于能力量化评价的航天器自主运行技术 **Speaker:** Dayi Wang　　　　China Academy of Space Technology, China **Chair:** Xiang Yu　　　　Beihang University		
特邀报告 6/Invited Lecture 6	11:20-11:50	主会场/Main Room
拒止环境下的高精度导航技术及研究进展 **Speaker:** Xiyuan Chen　　　　Southeast University, China **Chair:** Xiang Yu　　　　Beihang University		
闭幕式/Closing Ceremony	11:50-12:20	主会场/Main Room
Chair: Youmin Zhang　　　　Concordia University		

分会场报告（Oral Sessions）

4 月 9 日（星期六）/ April 9（Saturday）

会场 1/Room 1	
下午/Afternoon 13:30-17:30	
Sat-1.1: Artificial Intelligence **Conference Number: 847 235 137, Time: 13:30-14:50 Chair: Zhenbing Qiu**	
13:30-13:50	**Short-Term Wind Direction Forecasting Based on Online Sequential Extreme Learning Machine** Junjie Guan (Xiamen University) Shaoping Shen* (Xiamen University)
13:50-14:10	**A Domain Adaption Based Closed-loop System for Fault Diagnosis of Generator Slot Wedge** Bochen Li (Shanghai Jiao Tong University) Wenbin Yu* (Shanghai Jiao Tong University)
14:10-14:30	**A Dynamic Neighborhood based Multi-objective Particle Swarm Optimizer for Multimodal Multi-objective Problems** Rui Ge (Yangzhou University) Enze Zhang* (Yangzhou University) Yi Yang (Yangzhou University)
14:30-14:50	**Design of Attitude Measurement System Based on Multiple MEMS Sensors** Yaqin Sun* (Navy Submarine Academy) Weixing Xia (Navy Submarine Academy) Mingsong Li (Navy Submarine Academy)
中场休息/Break 14:50-15:10	
Sat-1.2: Multi-Sensors in Polar Navigation and Integrity monitoring Applications **Conference Number: 362 165 172, Time: 15:10-17:30 Chair: Nan Zang, Zhenbing Qiu**	
15:10-15:30	**Tightly Coupled GNSS, INS and Visual Odometry for Accurate and Robust Vehicle Positioning** Tianxia Liu* (Tongji University) Bofeng Li (Tongji University) Ling Yang (Tongji University) Guang Chen \'e (Tongji university) Linkun He (Tongji University) Jiaqi He (Tongji University)
15:30-15:50	**Maritime availability of BDS/GNSS ARAIM in the Arctic** Chun Jia* (Harbin Engineering University) Yongqi Weng (Harbin Engineering University) Chongyang Lee (Harbin Engineering University)
15:50-16:10	**Polar SINS/USBL Integrated Navigation Algorithm Considering Acoustic Communication Delays** Sixiang Cheng (Harbin Engineering University)

	Jianhua Cheng* (Harbin Engineering University)
	Nan Zang (Harbin Engineering University)
	Jing Cai (Harbin Engineering University)
16:10-16:30	**A New Polar Integrated Alignment Algorithm with the Aids of DVL and the Improved Polarized-light Navigation**
	Jiaxin Liu (Harbin Engineering University)
	Lin Zhao (Harbin Engineering University)
	Bing Qi (Harbin Engineering University)
	Jianhua Cheng* (Harbin Engineering University)
	Jing Cai (Harbin Engineering University)
16:30-16:50	**A Tightly Coupled Polarization Compass and VIO Integrated Navigation for Applications in GNSS-denied environments**
	Jing Li (Beihang University)
	Shanpeng Wang (Beihang University)
	Panpan Huang* (Hangzhou Innovation Institute, Beihang University)
	Xiao Zhang (Beihang University)
16:50-17:10	**The SBAS Ephemeris Correction and Integrity Parameter Analysis based on Recursive Least Square Algorithm**
	Yaozhao Tian* (Chang An University)
17:10-17:30	**Optimized Configuration of Electric Vehicles and Renewable Distributed Generation in V2G mode**
	Ruijin Dai (Zhejiang Huayun Information Technology Co. Ltd)
	Jianming Chen (Zhejiang Huayun Information Technology Co. Ltd)
	Yilin He (Zhejiang Huayun Information Technology Co. Ltd)
	Wenlan Cai (Zhejiang Huayun Information Technology Co. Ltd)
	Jiangtao Yu* (China Jiliang University)

会场 2/Room 2

下午（Afternoon） 13:30-17:30

Sat-2.1: Autonomous Systems
Conference Number: 360 601 270, Time: 13:30-14:50   Chair: Lan Gao

13:30-13:50	**Unmanned Transportation System in Future Cities**
	Yanan Yu* (95894 PLA troops)
	Qiang Yu (95894 PLA unit)
	Zheng Liu (Aviation University)
	Hongxia Ji (Beihang University)
13:50-14:10	**A Comparative Study of TDLAS-based UAV Plume Tracing Algorithms**
	Funing Xie (Tianjin University of Technology and Education)
	Jigong Li* (Tianjin University of Technology and Education)
14:10-14:30	**The Improved YOLO-V5 Based Automatic Non-parking Overloading Detection Method**
	Gonglin Lu (Chongqing University)
	Yujuan Wang* (Chongqing University)
14:30-14:50	**UAV Fuel Allocation Method Based on Centroid Balance**
	Jintao Yu* (Air Force Early Warning Academy)

	Bing Xiao (Air Force Early-warning Academy)
	Jiajun Xiong (Air Force Early Warning Academy)

<center>中场休息/Break 14:50-15:10</center>	

Sat-2.2: Autonomous Systems

Conference Number: 211 628 919, Time: 15:10-17:30   Chair: Lan Gao

15:10-15:30	**Optimization of Group Preventive Maintenance Method for Aircraft Oriented to Combat Readiness** Li Yang (Beihang University) Yi Chen (Beihang University) Xiaobing Ma* (Beihang University) Tianyi Wu (Beihang University) Chaoxiong Cui (Xi'an Aircraft Industry Group Company) Yanyan Wang (Southwest Institute of Technology and Engineering)Name3 University
15:30-15:50	**Research on Modeling of Multi-Observation Polarization Aided Bionic Compound Eye Integrated Navigation System and Observability Analysis Method** Haitao Liu* (Beihang University) Jian Yang (Beihang University) Xin Liu (Beihang University) Shanpeng Wang (Beihang University)
15:50-16:10	**Research on UAV Autonomous Deformation Strategy based on Deep Learning** Zhiguo Song (China Academy of Launch Vehicle) Yicong Lin* (Beihang University) Ruilin Lv (Beihang University) Aojia Ma (China Academy of Lanuch Vehicle Technology) Chaoyang Dong (Beihang University)
16:10-16:30	**Capture the Flag Based Assignment Algorithm for Tracking Task of Multi-UAVs** Dalei Song (Shenyang University of Technology) Aoliang Dai (Northeastern University) Xiaoqian Wang (Northeastern University) Hongjun Ma (Northeastern University) Donghui Wei* (Beijing Electro-mechanical Engineering Institute)
16:30-16:50	**Robust Backstepping Sliding Mode Control for Coaxial Tilt Rotor UAV** Weigang Cheng (Dalian University of Technology) Rui Wang* (Dalian University of Technology) Yuanhui Li (Dalian University of Technology)
16:50-17:10	**Maneuvering Planning for UAVs in Forest Surveillance and Fire Detection Missions with Kinematic Uncertainties** Lidong Zhang* (China Aeronautical Radio Electronics Research Institute) Ziyu Zhao (China Institute of Aeronautical Radio Electronics) Lingxia Mu (Xi'an University of Technology) Zhixiang Liu (Concordia University)

	YuFei Fu (Concordia University)
	Youmin Zhang (Concordia University)
17:10-17:30	**Modelling and Calibration of a High-Frequency Polarization Sensor: Applying to Underwater Variable Ambient Light Environment**
	Chunchun You* (Beihang University)
	Pengwei Hu (Beihang University)
	Jian Yang (Beihang University)
	Xin Liu (Beihang University)

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会场 3/Room 3

下午（Afternoon） 13:30-17:30

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Sat-3.1: Autonomous Systems and Intelligent Control
Conference Number: 583 478 201, Time: 13:30-14:50   Chair: Zhen Wang

13:30-13:50	**An Anti-radiation Missile Seeker's Multi-Objective DOA Estimation Algorithm Based on Uniform Circular Array Decoherent Solution**
	Yin Xi (Shanghai Radio Equipment Research Institute)
	Xiongjun Wu* (The 802 Institute of Shanghai Academy of Space Flight Technology)
	Yongwu Zhao (The Eighth Academy of China Aerospace Science and Technology Corporation)
	Hongfeng Meng (The Eighth Academy of China Aerospace Science and Technology Corporation)
	Qianrong Lu (Shanghai Radio Equipment Research Institute)
13:50-14:10	**Composite Anti-Disturbance Control for Interval Type-2 Fuzzy System via Disturbance Observer**
	Zhe Sun (Beijing Jiaotong University)
	Xiuming Yao* (Beijing Jiaotong University)
14:10-14:30	**Event-Triggered Anti-disturbance Tracking Control of non-Gaussian Stochastic Distribution Systems with Exogenous Disturbances**
	Xudong Wu (Yangzhou University)
	Peng Zhou (Yangzhou University)
	Yi Yang* (Yangzhou University)
	Songyin Cao (Yangzhou University)
14:30-14:50	**A Resampling Strategy Based Adaptive Diagnosis Method for Industrial Machinery Faults**
	Jing Yang* (Tianshui Normal University)
	Guo Xie (Xi'an University of Technology)
	Yanxi Yang (Xi'an University of Technology)

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中场休息/Break   14:50-15:10

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Sat-3.2: Intelligent Control and Automation
Conference Number: 294 791 019, Time: 15:10-17:30   Chair: Zhen Wang

15:10-15:30	**Vehicle Load Monitoring Method Based on NBIOT**
	Huixin Zhang* (Northeastern University)
	Yiding Zhao (Northeast University at Qinhuangdao)

15:30-15:50	**Research on HIL Simulation with SIMATIC Controller for Bladed** Yan Tian* (MingYang Smart Energy Group) Dan Tan (MingYang Smart Energy Group., Co., Inc) Sifan Chen (MingYang Smart Energy Group Co., Inc) Guangwei Zhu (MingYang Smart Energy Group Co., Inc)
15:50-16:10	**Design of Differential Game Guidance Law for Dual Defense Aircrafts** Xintao Wang (Harbin Institute of Technology) Ke Guo (Beijing Institute of Space Long March Vehicle) Tao Chao (Harbin Institute of Technology) Songyan Wang* (Harbin Institute of Technology)
16:10-16:30	**Image Reconstruction with Event Cameras Based on Asynchronous Particle Filter** Xinghua Liu* (Xi'an University of Technology) Jianwei Guan (Xi'an University of Technology) Rui Jiang (National University of Singapore) Xiang Gao (Xi'an University of Technology) Shuzhi Ge (National University of Singapore)
16:30-16:50	**An Improved Self-adapting Corner Detection Algorithm for Low-contrast Images** Yue Wang* (Nanjing University of Aeronautics and Astronautics) Xiong Tang (The 28th Research Institute of China Electronics Technology Group Corporation) Menglei Xia (The 28th Research Institute of China Electronics Technology Group Corporation)
16:50-17:10	**Parallel Commutation Error Compensation Strategy for Sensorless Brushless DC Motor with Asymmetric Back-EMF** Haifeng Zhang (Beihang University) Lirong Deng* (Beihang University) Hao Jin (Beihang University)
17:10-17:30	**Automatic Optimization Method of Commutation for Position Sensorless Brushless DC Motor Based on DC-link Voltage** Hao Jin* (Beihang University) Haifeng Zhang (Beihang University) Lirong Deng (Beihang University)
	**会场 4/Room 4**
	**下午（Afternoon） 13:30-17:30**
	**Sat-4.1: Invariant Kalman Filtering with Navigation Applications and Multi-Sensor Fusion for Autonomous Systems** **Conference Number: 714 415 276, Time: 13:30-14:50 Chair: Yuanxin Wu, Yuhong Li**
13:30-13:50	**Right Invariant SE2 (3)-EKF for Relative Navigation in Learning-based Visual Inertial Odometry** Yarong Luo (Wuhan University) Jianlang Hu (Wuhan University) Chi Guo* (Wuhan University)

13:50-14:10	**A Trident Quaternion Framework for The Inertial Navigation Initial Alignment**
	Ouyang Wei (Shanghai Jiao Tong University)
	Yuanxin Wu* (Shanghai Jiao Tong University)
14:10-14:30	**Introduction of LG-EKF Theory and its Applicaions**
	Jiarui Cui (National University of Defense Technology)
	Maosong Wang* (National University of Defense Technology)
	Wenqi Wu (National University of Defense Technology)
14:30-14:50	**A Multisensor-based Tightly Coupled Integrated Navigation System**
	Hu Sun (Zhejiang University of Technology)
	Yuqiang Jin (Zhejiang University of Technology)
	Minglei Fu (Zhejiang University of Technology)
	Junqiang He (Hangzhou HopeChart IoT Technology)
	Haomiao Liu (Hangzhou HopeChart IoT Technology)
	Wenan Zhang* (Zhejiang University of Technology)
	中场休息/ Break 14:50-15:10

Sat-4.2: Modeling and Optimal Control for Networked Unmanned Systems
Conference Number: 671 753 256, Time: 15:10-17:30   Chair: Yuhong Li

15:10-15:30	**Robust Predictive Control for Connected Automated Vehicles Based on Predicted Velocity of Leading Vehicle**
	Yanghui Feng* (Zhejiang University of Technology)
	Defeng He (Zhejiang University of Technology)
	Nengzhuo Li (Zhejiang University of Technology)
15:30-15:50	**MPC-based Tilting and Forward Motion Control of Quadruped Robots**
	Yongzhe Du (Northwestern Polytechnical University)
	Shunli Gao (Northwestern Polytechnical University)
	Huiping Li* (Northwestern Polytechnical University)
	Di Cui (Northwestern Polytechnical University)
15:50-16:10	**A Quasi Integral-Differential Type Event-Triggered MPC for Linear Systems**
	Ning He (Xi'an University of Architecture and Technology)
	Botao Bai (Xi'an University of Architecture and Technology)
	Zhongxian Xu* (Xi'an University of Architecture and Technology)
16:10-16:30	**Lagrangian Stability of Memristor-based Neural Networks with Unbounded Time-varying Delays**
	Xianhe Meng (Heilongjiang University)
	Junlan Wang (Heilongjiang University)
	Yantao Wang* (Heilongjiang University)
	Xin Wang (Heilongjiang University)
16:30-16:50	**Fault-tolerant Control for Constrained Unmanned Marine Vehicles based on Model Predictive Control with Integral Sliding Mode Control**
	Zhijie Wu (Dalian Maritime University)
	Li-Ying Hao* (Dalian Maritime University)
	Chao Shen (University of Victoria)
16:50-17:10	**Learning Model Predictive Control Law for Nonlinear Systems**

	Rizhong Wang (Northwestern Polytechnical University)
	Huiping Li* (Northwestern Polytechnical University)
	Demin Xu (northwestern polytechnical university)
17:10-17:30	**Deep Learning based Modeling and Control of Tiny Object on a Chladni Plate by Acoustic Vibration**
	Liandi Xu (Tianjin University of Technology)
	Hao Sun (Nankai University)
	Junqing Sun* (Tianjin University of Technology)
	Qinglin Sun (Nankai University)

分会场报告（**Oral Sessions**）

4 月 10 日（星期日）/ April 10（Sunday）

会场 1/Room 1

上午/Morning   8:30-11:50

Sun-1.1: Artificial Intelligence
Conference Number: 997 505 864, Time: 8:30-9:50   Chair: Kexin Guo

8:30-8:50	**Image-enhanced YOLOv5 and Deep Sort Underwater Multi-moving Target Tracking Method** Xing Cheng (Shanghai Maritime University) Wei Zhang (Shanghai Maritime University) Bing Sun* (Shanghai Maritime University)
8:50-9:10	**A Novel Anti-swing Initial Alignment Method based on Polarization/Geomagnetism Fusion for Ships Working on Unfamiliar Waters** Jie Zhang (Beihang University) Zhenbing Qiu (Hangzhou Innovation Institute, Beihang University) Lei Guo* (Beihang University)
9:10-9:30	**Application of Center Net Technology in the Process of Shipborne Aircraft Autonomous Landing** Zhuo Zhang (National University of Defense Technology) Qing Shi (National University of Defense Technology) Hui Huang (AVIC Shenyang Aircraft Design & Research Institute) Xiaoliang Sun* (National University of Defense Technology)
9:30-9:50	**Multi-stage Knowledge Enhancement for Ultra-fine-grained Entity Typing** Yuxiao Yang* (Shanghai Jiao Tong University) Ning Li (Shanghai Jiao Tong University)

中场休息/ Break   9:50-10:10

Sun-1.2: Advanced Control Theory and its Applications in UAVs
Conference Number: 416 600 092, Time: 10:10-11:50   Chair: Bailing Tian, Kexin Guo

10:10-10:30	**Adaptive Finite-Time Attitude Tracking Control for Rigid Spacecraft Systems with State Constraints** Lin Zhao* (Qingdao University)
10:30-10:50	**Extended State Observer-Based Saturated Finite-Time Tracking Control for A Class of Nonlinear Systems** Shengjie Cao (University of Science and Technology Beijing) Jinwei Wang (University of Science and Technology Beijing) Liang Sun* (University of Science and Technology Beijing)
10:50-11:10	**Real-time Trajectory Optimization for Flexible wing-UAV Based on Reinforcement Learning** Jiaming Yu (Tianjin University of Technology) Hao Sun (Nankai University) Junqing Sun* (Tianjin University of Technology)

	Qinglin Sun (Nankai University)
11:10-11:30	**Automatic Detection Algorithm of Mine Detection Based on Improved YOLOv5 in Complex Underwater Environment for AUV** Yuxin Zhao* (Harbin Engineering University) Xue Shang (Harbin Engineering University) Enjiao Zhao (Harbin Engineering University) Zhengyang Wang (Harbin Engineering University)
11:30-11:50	**Adaptive Dynamic Task Allocation and Robust Control Scheme for Target Tracking** Xinyi Zhao* (Tianjin University) Chunyu Zhang (CAUC) Hang Du (Civil Aviation University of China)
	**下午/Afternoon 13:30-16:30**

Sun-1.3: Autonomous Systems
Conference Number: 545 296 742, Time: 13:30-14:50   Chair: Jindou Jia

13:30-13:50	**A Bioinspired Polarization Sensor/Sun Tacker/IMU Integrated System for Attitude Determination in GNSS-Challenged Environments** Qiongyao Han (Beihang University) Taihang Chen (Beihang University) Panpan Huang* (Hangzhou Innovation Institute, Beihang University) Xin Liu (Beihang University)
13:50-14:10	**Design of Adaptive Sliding Mode Guidance Law Considering Trajectory Bulge** Yang Li* (Beijing Aerospace Technology Institute) Qing Liu (Beijing Aerospace Technology Institute) Ting Yang (Northwestern Polytechnical University)
14:10-14:30	**Early Forest Fire Recognition Method Based on C-GhostNet Network** Mengna Li (Xian University of Technology) Youmin Zhang* (Concordia University) Lingxia Mu (Xi'an University of Technology) Jing Xin (Xi'an University of Technology) Ziquan Yu (Nanjing University of Aeronautics and Astronautics) Shangbin Jiao (Xi'an University of Technology) Han Liu (Xi'an University of Technology) Guo Xie (Xi'an University of Technology) Yingmin Yi (Xi'an University of Technology)
14:30-14:50	**A Multi-UAVs Formation Control Design Method with Disturbance Rejection for Under-actuated Cascaded Two Loop Mechanism** Xiongjun Wu* (802 Institute of Shanghai Academy of Space FlightTechnology) Hongbo Zhao (Beihang University) Xiangyu Meng (Louisiana State University)
	**中场休息/ Break 14:50-15:10**

Sun-1.4: Autonomous Systems and Emerging Technologies
Conference Number: 470 454 718, Time: 15:10-16:30   Chair: Jindou Jia

15:10-15:30	**Prediction Analysis of Target State in Spacecraft Pursuit Game** Zhen Zhang (Northwestern Polytechnical University) Chong Sun* (Northestern Polytechnical University) Jianlin Chen (Northwestern Polytechnical University) Xiaolong Wang (School Of Astronautics, Northwestern Polytechnical University) Qun Fang (Northwestern Polytechnical University) Zhanxia Zhu (Northwestern Polytechnical University)
15:30-15:50	**Multi-spacecraft Cooperative Control Method for Malfunctioning Spacecraft Pursuit** Xiaolong Wang (School Of Astronautics, Northwestern Polytechnical University) Ruifeng Li (School Of Astronautics,Northwestern Polytechnical University) Chong Sun* (Northestern Polytechnical University) Qun Fang (Northwestern Polytechnical University)
15:50-16:10	**Hypersonic Vehicle Control System Design with a Blended Pneumatic and Thrust Vectoring Control Strategy** Qi Chen (Fudan University) Jing Wan* (Fudan University) Guangshan Chen (Shanghai Aerospace Control Technology Institute)
16:10-16:30	**Autonomous Rescue System Based on Neural Networks for Thrust Drop Fault of Launch Vehicles** Xiao He (Dalian University of Technology) Shujun Tan* (Dalian University of Technology) Zhigang Wu (Dalian University of Technology)
会场 2/Room 2	
上午/Morning 8:30-11:50	
Sun-2.1: Artificial Intelligence, Robotics and Networked Control Systems **Conference Number: 723 287 041, Time: 8:30-9:50 Chair: Hao Lu**	
8:30-8:50	**A Deep Learning Method based on SRN-YOLO for Forest Fire Detection** Yuncong Li (Chongqing University) Zhixi Shen* (Chongqing University) Junbei Li (Chongqing University) Zanlin Xu (Chongqing University)
8:50-9:10	**A Robust Point Cloud Registration Method for Structured Scenes Based on Plane Elements Using Global Information** Zhao Zhou (Beijing University of Posts and Telecommunications) Yaojun Qiao* (Beijing University of Posts and Telecommunications) Aiying Yang (Beijing Institute of Technology)
9:10-9:30	**State Prediction for Smart Grids under DoS Attack using State Correlations under optimized PMU deployment** Chunye Wang* (Southwest University)
9:30-9:50	**Observer-Based Load Frequency Control for Multi-Area Power System Considering Renewable Energy and Electric Vehicles** Xinghua Liu* (Xi'an University of Technology)

	Yuru Liang (Xi'an University of Technology)
	Dongyu Li (Harbin Institute of Technology)
	Siwei Qiao (Hubei Normal University)
	Hui Cao (Xi'an Jiao Tong University)

中场休息/ Break　9:50-10:10

Sun-2.2: Fault-Tolerant Control for Unmanned Systems
Conference Number: 487 400 180, Time: 10:10-11:50　Chair: Yajie Ma, Hao Lu

10:10-10:30	**Fault-Tolerant Control and Vibration Suppression of Flexible Hypersonic Vehicles**
	Dong Zhao (Anhui University)
	Wenjing Ren* (Hefei University of Technology)
	Cunsong Wang (Nanjing University of Technology)
10:30-10:50	**Spacecraft Attitude Tracking Control Based on MPC and Fractional-order Sliding Mode Control**
	Xinli Yu (Nanjing Tech University)
	Hui Yi* (Nanjing Tech University)
	Zehui Mao (Nanjing University of Aeronautics and Astronautics)
10:50-11:10	**Fault Tolerant Cooperative Control for Nonlinear Multi-agent Systems Based on Topology Reconfiguration**
	Huiliao Yang* (Nanjing University of Aeronautics and Astronautics)
11:10-11:30	**Projection Operator-Based Fault-Tolerant Backstepping Adaptive Control of Fixed-Wing UAV Against Actuator Faults**
	Zhongyu Yang (Nanjing University of Aeronautics and Astronautics)
	Ziquan Yu* (Nanjing University of Aeronautics and Astronautics)
	Youmin Zhang (Concordia University)
	Yuehua Cheng (Nanjing University of Aeronautics and Astronautics)
	Guili Xu (Nanjing University of Aeronautics and Astronautics)
	Minrui Fu (Nanjing University of Aeronautics and Astronautics)
	Ruifeng Zhou (Nanjing University of Aeronautics and Astronautics)
11:30-11:50	**L_∞ Fault Estimation Observer Design for Discrete-time Linear Parameter-Varying Systems**
	Wenhan Zhang (Harbin Institute of Technology)
	Zhenhua Wang* (Harbin Institute of Technology)
	Yi Shen (Harbin Institute of Technology)

下午/Afternoon　13:30-16:30

Sun-2.3: Distributed Estimation in Sensor Network for Autonomous Systems
Conference Number:139 489 429, Time: 13:30-14:50　Chair: Wenchao Xue, Sicheng Zhou

13:30-13:50	**Security Analysis of Distributed Consensus Filtering under Replay Attacks**
	Jiahao Huang* (East China University of Science and Technology)
	Yang Tang (East China University of Science and Technology)
13:50-14:10	**A Distributed State Estimation Algorithm towards a Class of Bearings-only Sensor Networks**
	Chenxu Liang (Chinese Academy of Sciences)
	Wenchao Xue* (Chinese Academy of Sciences)

	Haitao Fang (Chinese Academy of Sciences)
14:10-14:30	**Active Disturbance Rejection Control based Distributed Resource Allocation Algorithm for Second-order Multi-agent Systems with Both External Time-varying Disturbances and Internal Uncertainties** Shuqing Duan (Shaanxi Normal University) Ruonan Yuan (Shaanxi Normal University) Zhiliang Zhao* (Shaanxi Normal University) Sen Chen (Shaanxi Normal University) Wenchao Xue (Chinese Academy of Sciences)
14:30-14:50	**Multi-Party Dynamic State Estimation that Preserves Data and Model Privacy** Yuqing Ni* (Jiangnan University) Junfeng Wu (KTH,Royal Institute of Technology) Li Li (Tongji University) Ling Shi (Hong Kong University of Science and Technology)

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Sun-2.4: Intelligent Control and Emerging Technologies
Conference Number: 676 182 475, Time: 15:10-16:30   Chair: Sicheng Zhou

15:10-15:30	**M2-Conformer: Multi-modal CNN-Transformer for Driving Behavior Detection** Jun Gao* (Jianghan University) Jiangang Yi (Wuhan University of Science and Technology) Yi Lu Murphey (University of Michigan-Dearborn)
15:30-15:50	**Automated Tuning of MPC for VAV System Based on LSTM** Ning He (Xi'an University of Architecture and Technology) Kun Xi (Xi'an University of Architecture and Technology) Mengrui Zhang* (Xi'an University of architecture and technology)
15:50-16:10	**Consensus Control with a Constant Gain of Linear Multi-Agent Systems with Binary-Valued Communication** Zhipeng Ren (University of Science and Technology Beijing) Ting Wang* (Chinese academy of sciences)
16:10-16:30	**Suppression of Moving Gimbal Effects of the AMB-rotor System Considering Multi-channel Coupling Current** Yulin Chen* (Beihang University) Bangcheng Han (Beihang University) Shiqiang Zheng (Beijing University of Aeronautics and Astronautics) Yangyang Shi (Beijing Institute of Technology)

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<tr><td align="center">会场 3/Room 3</td></tr>
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<tr><td align="center">上午/Morning   8:30-11:50</td></tr>
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Sun-3.1: Autonomous Systems
Conference Number: 517 642 459, Time: 8:30-9:50   Chair: Jianliang Wang, Zaoxu Zhu

8:30-8:50	**Bipartite Consensus Control for Linear Multi-Agent Systems with Disturbance** Guan Huang* (Northwestern Polytechnical University) Zhuo Zhang (Northwestern Polytechnical University)

	Weisheng Yan (Northwestern Politechnical University)
	Huiping Li (Northwestern Polytechnical University)
8:50-9:10	**A Real-Time Forest Fire Recognition Method Based on R-shufflenetv2**
	Mengna Li (Xian University of Technology)
	Youmin Zhang* (Concordia University)
	Lingxia Mu (Xi'an University of Technology)
	Jing Xin (Xi'an University of Technology)
	Xianghong Xue (Xi'an University of Technology)
	Shangbin Jiao (Xi'an University of Technology)
	Han Liu (Xi'an University of Technology)
	Guo Xie (Xi'an University of Technology)
	Yingmin Yi (Xi'an University of Technology)
9:10-9:30	**Fixed-time Fault Estimation Observer Design for Interconnected Systems**
	Qingyi Liu (Nanjing University of Aeronautics and Astronautics)
	Ke Zhang* (Nanjing University of Aeronautics and Astronautics)
	Jingping Xia (Nanjing University of Aeronautics and Astronautics)
	Bin Jiang (Nanjing University of Aeronautics and Astronautics)
9:30-9:50	**Continuous Fixed-time Sliding Mode Output Feedback Control for Hypersonic Vehicles**
	Haibin Sun* (Qufu Normal University)
	Yawen Wang (Qufu Normal University)
	Linlin Hou (Qufu Normal University)
中场休息/ Break 9:50-10:10	
Sun-3.2: Reliability Analysis, Fault Prognostics and Health Management for Autonomous Systems **Conference Number: 989 985 479, Time: 10:10-11:50 Chair: Han Wang, Zaoxu Zhu**	
10:10-10:30	**Performance Evaluation of BDS/GNSS Single-Frequency Precise Point Positioning with Ionospheric Constraint in Polar Regions**
	Guojing Zhao (Harbin Engineering University)
	Nan Zang* (Harbin Engineering University)
	Jianhua Cheng (Harbin Engineering University)
	Guanhua Qiu (Harbin Engineering University)
10:30-10:50	**Reliability Bounds of δ-Shock Model under Non-Homogeneous Poisson Process**
	Kewei Ye* (Beihang University)
	Xiaobing Ma (Beihang University)
	Yanyan Wang (Southwest Institute of Technology and Engineering)
10:50-11:10	**Condition-based Maintenance Optimization of Multiple-Component Series System under Semi-Markov Analytical Framework**
	Peng Tao (Beihang University)
	Li Yang* (Beihang University)
	Xiaobing Ma (Beihang University)
	Yanyan Wang (Southwest Institute of Technology and Engineering)
11:10-11:30	**Remaining Life Prediction for High-speed Rail Bearing Considering Hybrid Data-model-driven Approach**

	Jiantai Wang (Beihang University) Li Yang* (Beihang University) Xiaobing Ma (Beihang University) Yu Zhao (Beihang University) Guifa Huang (Beijing Tangzhi Science and Technology Development Co., Ltd.) Yanyan Wang (Southwest Institute of Technology and Engineering)
11:30-11:50	**Remaining Useful Life Prediction of Bearings with Two-stage LSTM** Qian Chen (Beihang University) Xiaobing Ma* (Beihang University) Bingxin Yan (Beihang University) Yanyan Wang (Southwest Institute of Technology and Engineering) Guifa Huang (Beijing Tangzhi Science and Technology Development Co., Ltd.)
	下午/Afternoon　　13:30-16:50

Sun-3.3: Cooperative Guidance, Navigation, and Control (GNC) of Autonomous Systems
Conference Number: 448 354 124, Time: 13:30-14:50　　Chair: Jianan Wang, Jingting Jia

13:30-13:50	**Research on Artificial Bee Colony Method Based Complete Coverage Path Planning Algorithm for Search and Rescue Robot** Liu Yang (Shanghai Ocean University) Bowen Xing* (Shanghai Ocean University) Cai Li (South China Sea Oceanographic Research Institute) Wugui Wang (China Ship Development and Design Center)
13:50-14:10	**Performance of PPN Guided Missile with Arbitrary Time-Varying Speed against Stationary Targets: New Findings** Kebo Li* (National University of Defense Technology) Yuanhe Liu (National University of Defense Technology) Yangang Liang (National University of Defense Technology) Lei Chen (National University of Defence technology)
14:10-14:30	**A Multi-missile Cooperative Guidance Law for Scattered Targets** Jianan Wang (Beijing Institute of Technology) Pengda Lin (Beijing Institute of Technology) Liang Li* (Beijing institute of technology) Chunyan Wang (Beijing Institute of Technology) Jiayuan Shan (Beijing Institute of Technology)
14:30-14:50	**Optimization and Trajectory Tracking of Deep Stall Landing for a Variable Forward-Swept Wing UAV** Shuai Shao (Beijing Institute of Technology) Junhui Liu* (Beijing institute of technology) Jiayuan Shan (Beijing Institute of Technology) Weijia Zeng (Beijing Institute of Technology) Sidong Liu (System engineering research institute)

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中场休息/ Break　　14:50-15:10

Sun-3.4: Cooperative Guidance, Navigation, and Control (GNC) of Autonomous Systems
Conference Number: 320 200 606, Time: 15:10-16:50　　Chair: Jianan Wang, Jingting Jia

15:10-15:30	**Consensus Control of Multi-Agent Systems Based on Adaptive Disturbance Observer** Xiaoyan Li (Beijing Institute of Technology) Jiayuan Shan (Beijing Institute of Technology) Chunyan Wang* (Beijing Institute of Technology) Jianan Wang (Beijing Institute of Technology)
15:30-15:50	**Formation Tracking Stabilization Control for Fixed-wing UAVs with Planar Motion** Ruizhou Gao (Science and Technology on Electro-optic Control Laboratory) Chenghua He (Nanjing University of Aeronautics and Astronautics) Zengmao Wang (Nanjing University of Aeronautics and Astronautics) Xiuhui Peng* (Nanjing University of Aeronautics and Astronautics)
15:50-16:10	**GAN-SLAM: GAN based Monocular Visual-Inertial Simultaneous Localization and Mapping in Dark Environments** Qieshi Zhang (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences) Luoying Hao (University of Chinese Academy of Sciences) Hongjian Lee (Shenzhen Institute of Advanced Science and Technology, Chinese Academy of Sciences) Ziliang Ren (Chinese Academy of Sciences) Jun Cheng* (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences)
16:10-16:30	**Prescribed Performance RISE-based Control of Euler-Lagrange Systems under Saturation** Lan Cao (Chongqing University) Xiucai Huang (Chongqing university) Hefu Ye (Chongqing University) Yongduan Song* (Chongqing university)
16:10-16:50	**Privacy Preservation in Cooperative Remote State Estimation** Xiaoping Yu (East China University of Science and Technology) Chao Yang* (East China University of Science and Technology)
	**会场 4/Room 4**
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Sun-4.1: Fault Diagnosis and Pattern Recognition, and Resource-Efficient Networking and Control of Autonomous Systems
Conference Number: 184 325 984, Time: 8:30-9:50   Chair: Fuyang Chen, Wenshuo Li

8:30-8:50	**Adaptive Fault-tolerant Control of Air-breathing Hypersonic Vehicles with Variable Geometry Inlet** Zian Cheng* (AnHui University of Technology)
8:50-9:10	**Time-delay System Compensation and Intermittent Fault Tolerance Control based on Adaptive Sliding Mode Control** Qihang Zhang (Nanjing University of Aeronautics and Astronautics) Fuyang Chen* (Nanjing University of Aeronautics and Astronautics) Zongqi Li (Nanjing University of Aeronautics and Astronautics)

9:10-9:30	**Composite Fault Diagnosis of Fighter Based on Wavelet Packet Decomposition and Extreme Gradient Boosting Tree**
	Xifeng Zhong (Nanjing University of Aeronautics and Astronautics)
	Fuyang Chen* (Nanjing University of Aeronautics and Astronautics)
	Jiaao Yang (Nanjing University of Aeronautics and Astronautics)
9:30-9:50	**Area Control of Unmanned Aerial Vehicles Swarm based on Lanner-Jones Potential**
	Jintao Liu* (Army Engineering University)
	中场休息/ Break 9:50-10:10

Sun-4.2: Fault Diagnosis and Fault-Tolerant Control and Their Applications
Conference Number: 407 803 295, Time: 10:10-11:50   Chair: Ke Zhang, Wenshuo Li

10:10-10:30	**Prediction of Remaining Useful Life Based on SSA-RVM-PF Method for Lithium-ion Battery**
	Zhou Meng (North China University of Technology)
	Chang Cai (North China University of Technology)
	Jing Wang* (North China University of Technology, China)
	Wang Chang (Beijing Aerospace Automation Research Institute)
10:30-10:50	**Anti-attack Fault-tolerant Control of Multi-agent Systems with Complicated Actuator Faults and Cyber Attacks**
	Chun Liu* (Shanghai University)
	Yue Shi (Shanghai University)
10:50-11:10	**Prescribed Performance Control of Air-breathing Hypersonic Vehicle with Propulsion System Constraint**
	Jing Wan* (Fudan University)
	Guangshan Chen (Shanghai Aerospace Control Technology Institute)
11:10-11:30	**Adaptive Fault-Tolerant Control of Heterogeneous Multi-Agent Systems With Actuator Faults**
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	Ke Zhang* (Nanjing University of Aeronautics and Astronautics)
	Bin Jiang (Nanjing University of Aeronautics and Astronautics)
	Yong Ding (Nanjing University of Aeronautics and Astronautics)
11:30-11:50	**Intermediate Observer based Fault-Tolerant Control for Fuzzy Stochastic Systems with Actuator Fault**
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	Jian Han* (Northeastern University)
	Xiuhua Liu (Northeastern University)

下午/Afternoon   13:30-16:30

Sun-4.3: Sensing, Control and Security of Robotic Systems
Conference Number: 408 729 027, Time: 13:30-14:50   Chair: Shangke Lyu, Yanran Wei

13:30-13:50	基于双隐层输出反馈神经网络快速非奇异终端滑模的自主车辆路径跟踪控制 Zhe Sun* (Zhejiang University of Technology)
13:50-14:10	**Visual Servoing of Manipulator with Moving base**
	Xiaoyu Ma* (Beihang University)
	Shangke Lyu (Beihang University)

	Jianzhong Qiao (Beihang University)
	Yukai Zhu (Beihang University)
14:10-14:30	**Covariance Intersection Fusion Approach for Gait Estimation of Lower Limb Rehabilitation Exoskeleton Robot**
	Yuan Zhou (Zhejiang University of Technology)
	Zhongyao Hu (Zhejiang University of Technology)
	Zhe Sun (Zhejiang University of Technology)
	Tian Wang (Hangzhou Robot Technology Development Co.,LTD)
	Bo Chen* (Zhejiang University of Technology)
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	Linfan Yu (Zhejiang University)
	Zehao Yan (Zhejiang University)
	Linghui Xu (Zhejiang university)
	Wei Yang* (Zhejiang University)
	Canjun Yang (Zhejiang University)
	**中场休息/ Break 14:50-15:10**

Sun-4.4: Automation

Conference Number: 123 925 090, Time: 15:10-16:30   Chair: Yanran Wei

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	Yan Meng (Beihang University)
	Tianyu Liu (Beihang University)
	Ning Shen (Xian Modern Control Technology Research Institute of China)
	Jianchcun Zhang* (Hangzhou Innovation Institute, Beihang University)
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	Lei Zhao (Beijing Institute of Control Engineering)
	Yukai Zhu (Beihang University)
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	Ziyu Zhao* (China Institute of Aeronautical Radio Electronics)
	Lidong Zhang (China Aeronautical Radio Electronics Research Institute)
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	Ning He (Xi'an University of Architecture and Technology)
	Liqiang Liu (Xi'an University of Architecture and Technology)
	Danlei Chu (Optimal Process Control Techonlogies Co.,Ltd)
	Cheng Qian* (Xì'an University of Architecture and Technology)

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