

School of Mechatronic Engineering and Automation





School of Mechatronic Engineering and Automation



School's Vision

- Source of scientific and technological innovation
- Cradle of engineering talents
- Industry-university research cooperation
- International cooperation



School's Aim

- Boosting economic
 development
- Cultivating
 innovative talents
- Promoting scientific and technological progress
- Serving social needs



School's Culture

- People oriented
- Solidarity and cooperation
- Down-to-earth
- Pioneering and enterprising



School's Style

- Keep with the times
- Pragmatic
- Positive and proactive
- Striving for the first rate



School Structure

School of Mechatronic Engineering and Automation Multidisciplinary Intersection of mechanics, electricity, measurement and control



Department
of
Precision
Mechanical
Engineering

Department of Automation Department of Electrical Engineering Institute of Unmanned Surface Vehicle Engineering Key Laboratory of Advanced Display and System Application















Disciplines

Four first-level disciplines



Total number of faculty and staff: 389人

- Full-time faculty: 276人
- Professors (Researchers): 73人
- Faculty with Ph.D. degree: 247人

Total number of students: 4323人

- Master & doctoral students: ~2141人
- Undergraduate students: ~2182人



Postdoctoral Research Stations and Doctoral Programs

3 Postdoctoral research stations

- Mechanical Engineering
- Control Science and Engineering
- Electrical Engineering



3 Authorized Disciplines for Doctoral Degree

- Mechanical Engineering
- Control Science and Engineering
- Electrical Engineering

	15 Doctoral Programs
1	Mechanical Manufacturing and Automation
2	Mechatronic Engineering
3	Mechanical Design and Theory
4	Vehicle Engineering
5	Additive Manufacturing and Tissue Repair (cross discipline)
6	Control Theory and Control Engineering
7	Detection Technology and Automation Equipment
8	Systems Engineering
9	Pattern Recognition and Intelligent System
10	Navigation, Guidance and Control
11	Motor and Electrical Appliances
12	Power System and Its Automation
13	High Voltage and Insulation Technology
14	Power Electronics and Power Drive
15	Electrical Theory and New Technology



Master Programs

16 Master Programs

1	Mechanical Manufacturing and Automation					
2	Mechatronic Engineering					
3	Mechanical Design and Theory					
4	Vehicle Engineering					
5	Control Theory and Control Engineering					
6	Detection Technology and Automation Equipment					
7	Systems Engineering					
8	Pattern Recognition and Intelligent System					
9	Navigation, Guidance and Control					
10	Motor and Electrical Appliances					
11	Power System and Its Automation					
12	High Voltage and Insulation Technology					
13	Power Electronics and Power Drives					
14	Theory and New Technology of Electrical Engineering					
15	Measuring and Testing Technology and Instruments					
16	Precision Instruments and Machinery					

4 Authorized Disciplines for Master Degree

- Mechanical Engineering
- Control Science and Engineering
- Electrical Engineering
- Instrumentation Science
 and Technology





Department of Mechanical Automation Engineering

- Features and Positions: Focusing on the integrated scheme development of "teaching + innovation competition + scientific research + university-industry cooperation + international cooperation" with the cultivation of talents and scientific research.
- There are more than 100 teachers in the whole department, including 7 scholars at provincial and ministerial level, such as the National Distinguished Young Scholars, the Chang Jiang Scholars, and the National Ten-thousand Talents Program Scholars, 20 scholars with senior titles and 75% of scholars with a doctorate.
- The department has a postdoctoral program and a first-level doctoral program in mechanical engineering and a second-level doctoral program in mechanical manufacturing and automation, mechanical design and theory, and mechatronic engineering.
- The department has a master's degree in mechanical manufacturing and automation, mechanical design and theory, mechatronic engineering, and vehicle engineering and also has a full English major - mechanical manufacturing and automation for international students.
- The department has undergraduate majors in mechanical engineering and automation (the national first batch excellent undergraduate major), intelligent manufacturing engineering (the first batch major of Ministry of Education), industrial engineering and industrial design.
- The department has built nearly ten Shanghai boutique and key courses and obtained 2 first prizes of provincial teaching achievements. Every year, students win more than 50 first prizes in national, provincial and ministerial competitions.
- Five stable scientific research teams have been formed: "intelligent basic parts". "intelligent manufacturing technology and application", "robot and intelligent design", "optical electromechanical intelligent detection and equipment", "electro-hydraulic integrated control". In the past three years, the department has obtained more than 130 million research funding, 2 first prizes of provincial and ministerial science and technology award, achieved over 1.6 million in invention patents, established Industry-University-Research cooperation with nearly 50 companies in aerospace, automobile transportation, and marine equipment manufacturing and built a Shanghai high-level local university key innovation team "intelligent rehabilitation robot and wearable rehabilitation equipment".
- The department has signed a 3+1+1 joint training agreement with Purdue University, RWTH Aachen University, University of Toronto, University of Southampton and cooperate with Worcester Polytechnic University and Notre Dame University to carry out joint graduation design project.
- The department has scholarships for students up to 320,000 yuan every year from Fangzhou/Fangyao, Toyo Denso, Xinsong, Genggi, Zeiss, etc.





机械设计制造及自动化

First prize of Shanghai teaching achievements







Fang Yao Ziqiang Award Fang Zhou Zigiang Award

Shanghai May Fourth Youth Medal





Purdue Universitv Exchange Program











Department of Precision Mechanical Engineering

- ◆ After nearly 60 years of development, the Department of Precision Mechanical Engineering has formed a leading direction of teaching and research with opto-mechanical integration, cultivated a large number of students, and enjoyed a certain reputation at home and abroad.
- There are double first-class disciplines "mechanical engineering", the national key discipline "mechatronic engineering" and Shanghai's key disciplines "precision instruments and machinery", "mechanical manufacturing automation" and so on. It is an affiliated unit of the Precision Instrument Society of the Chinese Instrumentation Society, the deputy director of the Electronic Machinery Branch of China Electronics Society, and the secretariat of the Shanghai Robotics Society. It has established relationship with foreign universities in the United States, the United Kingdom, Japan, and Singapore.
- Participated in and undertaken a series of national and local major science and technology research projects, and won many first prizes of national and provincial science and technology progress awards.
- There are undergraduate majors of "Mechatronic Engineering "(the national excellent undergraduate major), "Measurement Control Technology and Instruments "(Accreditation of Engineering Education); master's majors of "Mechatronic Engineering", "Precision Instruments and Machinery" and "Vehicle Engineering"; PhD and post-doctoral programs in "Mechanical Engineering".
- Set up overseas study programs such as the summer practice mutual visit program of University of Nevada, the 3+1+1 program with University of Queensland, University of Kentucky, and National University of Singapore, etc.
- Establish cooperation relations with dozens of domestic groups and enterprises and set up innovation practice bases. There are 863 industrialization bases to realize the transformation of scientific research achievements. Enterprises set up more than ten scholarships.





- Historical profundity: Profound history and a long discipline inheritance, under the leadership of Boshi Chen. In 1994, the former School of Electrical Control of Shanghai University of Technology and the former Department of Automatic Control of Shanghai University of Science and Technology were merged, and then it was named School of Automation of Shanghai University.
- Cultivation conception: The department focuses on cultivating wide caliber, compound and highquality students which have the engineering awareness, innovation awareness and the engineering practice comprehensive ability for the country and Shanghai. The students have worked in the world's top 500 enterprises such as Huawei, Shanghai Electric, Intel and GE.
- Professional characteristics: Automation is an engineering technology subject with strong adaptability and wide application which combines "computer software with hardware, control theory with application". It is a multi-disciplinary interdisciplinary field of computer, communication, control, intelligent manufacturing and other majors.
- Platform base: "111 Center", Shanghai International Joint Laboratory of Intelligent Automation and Networked Control, Shanghai Key Laboratory of Power Station Automation Technology, Sino-Australian International Joint Laboratory of Machine Intelligence, two school-enterprise cooperation Shanghai engineering technology research centers, two Shanghai joint training base for postgraduates, two international industry-university-research cooperation joint laboratories, and one undergraduate experimental centers (labs).
- Academic awards: Enterprises, such as Shanghai Automatic Instrumentation, China Institute of Aeronautical Radio and Electronics, Simba Automation, Passionate about welding, cooperating with Department of Automation, have set up scholarships to reward outstanding students.
- Scientific research strength: Won more than 30 the first and second prize of National/Shanghai Science and Technology Awards and undertaken more than 100 national projects.
- Talent team: There are outstanding teachers such as Changjiang Scholars, Distinguished Young Scholars, Global "High Citation Scientists", Most Cited Chinese Researchers, etc.

HUAWEI_<u>Tencent</u>腾讯_





Department of Electrical Engineering





Key Laboratory

Shanghai Key Laboratory of Power Station Automation Technology

- 1. Power Station Information Detection and Intelligent Processing Technology
 - Advanced sensor technology
 - Signal processing, modelling and simulation
- 2. Power Automation Process System
 - Advanced control and optimizing strategy
 - Automation equipment technology
 - Network and automation system technology
- 3. New Energy Generation and Driving Control Technology
 - New energy power generation and its application
 - High density motor technology









Key Laboratory

Shanghai Key Laboratory of Intelligent Manufacturing and Robotics

- 1. Basic and functional parts
- 2. Robotics and its applications
- 3. Intelligent manufacturing technology and system





















Key Laboratory

Key Laboratory of Advanced Display and System Applications, Ministry of Education (Interdisciplinary)

Main research areas :

- 1. Advanced Display Materials, Components and Instruments
- 2. Advanced Packaging and Microsystem Integration, etc.



Key Laboratory of Advanced Display and System Applications, Ministry of Education

上海平板显示 工程技术研究中心

上海市科学技术委员会









Marine Intelligent Unmanned Equipment, Engineering Research Center of Ministry of Education

- 1. National major science and technology project in unmanned equipment
- 2. Development of marine exploration technologies and equipments for civil goods, military trade and law enforcement









111 Center

State Administration of Foreign Experts Affairs Ministry of Education Shanghai University Overseas Expertise Introduction Center for Discipline Innovation ("111 Center")

- 1. Frontier theory of complex networked systems
- 2. Applications of industrial internet technology, e.g. smart grid, intelligent manufacturing and intelligent medical devices.









Shanghai International Joint Laboratory of Intelligent Automation and Networked Control Shanghai University & Belgrade University Shanghai Science and Technology Commission

- 1. Frontier theory of intelligent automation and networked control
- 2. Intelligent energy system control, measurement, safety and key field applications









Joint Laboratory

UK-China Science Bridge Partner Joint Laboratory on Energy and Automation

Main research areas:

1. Sustainable Energy and Environment of UK-China Science Bridge Partners









Joint Laboratory

Shanghai University-NARI Group New Technology of Smart Grid Joint R & D Center

- 1. Application of new material for smart grid
- 2. New technologies of smart grid, including robots, smart city, etc.









Joint Laboratory

Intelligent Manufacturing and Robot Innovation Lab

Jointly developed by Shanghai University, Shanghai FANUC Robotics, Rockwell Automation China, Cisco China, Shanghai ABB Engineering, Zhongke SIASUN

- 1. Intelligent robot technology and application
- 2. Intelligent manufacturing technology and integrated system









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Joint Laboratory

Medical 3D Digital Demonstration Laboratory for Medical Application

Jointly developed by Creaform Canada (Creaform China) and School of Mechatronic Engineering and Automation of Shanghai University.

- Digital modeling and transformation in biomedical engineering
- Support unit:
- Consulate General of Canada
- Quebec Government Office in Shanghai



Wearable medical devices and equipment



Group photo of Counsellor, Consul, Deputy Consul of the Canadian and College Leaders





Research Funding

Annual scientific research funding continuously exceeds 100 million yuan in the last five years.





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Triboelectric nanogenerator sensors for soft robotics aiming at digital twin applications

Tao Jin, Zhongda Sun, Long Li, Quan Zhang, Minglu Zhu, Zixuan Zhang, Guangjie Yuan, Tao Chen, Yingzhong Tian 🖾, Xuyan Hou 🖾 & Chengkuo Lee 🖾

Nature Communications 11, Article number: 5381 (2020) Cite this article 6454 Accesses | 10 Citations | 1 Altmetric | Metrics

> Automatica Volume 113, March 2020, 108680



Defensive deception against reactive jamming attacks in remote state estimation 🖈

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Kemi Ding *쯔, Xiaoqiang Ren <sup>b</sup> 옷 쯔, Daniel E. Quevedo °쯔, Subhrakanti Dey <sup>d</sup> 쯔, Ling Shi *쯔
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Scientific Research Awards





New breakthroughs in key projects and steady growth in the number of national funds

National S innovation	cience and technon major project	logy	Wang Xiaofan, 6	.37 million			
National key research and development projects			Pu Huayan, 12.1	million Ministry of Science and		Xiaoqiang	
National key research and development projects			Fei Minrui, 11.99	million	Technology Key R & D project		
National key research and development projects			Peng Chen, 6.3	million	NSFC Major Project	Jianhua Zhang	
Major Projects of the Science and Technology Commission of the CMC			Peng Yan, 11.3 r	nillion	NSFC Major Cultivation	Dajun Du Li Jia	
National Outstanding Youth Natural Science Foundation			Pu Huayan, 2.87	million	p. ojočí		
Major enterprise projects			Cui Ze, 21.70 mi	llion			
	National Pro	jects Fundiı	ng (unit: million)		国家现代服务业重点专项首席 科学家工作委员会筹备会议		
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	55.83	60.13	82.78				



Serving the National Strategy



Unmanned Surface Vehicle went to the East China Sea to aid the "Sangji" cargo ship collision accident, including the following post-processing tasks.

- Determining the position and attitude of the wreck
- Surveying and mapping the depth of sunken ship area
- Collection of contaminated water and oil samples

This is the first time in China to use unmanned surface vehicle for emergency detection under marine environmental disasters. Important breakthroughs and discoveries of underwater archaeology in Shanghai and other places in China.

Underwater Archaeological Survey in 2018

- Proof of No.2 sunken ship at Yangtze Estuary
- Preliminary clearance of stern adjacent cabin 1
- 188 pieces of complete and restorable Jingdezhen kiln porcelain





Serving the National Strategy

Aiming at the national strategy of China's commercial aircraft manufacturing, the research on key technologies such as intelligent design, advanced bus test, function test and verification, engine flow field simulation, and simulated driving is carried out, and the Joint Laboratory of Advanced Test Technology for Civil Aircraft Assembly is established to assist C919 and ARJ21 intelligent manufacturing.





Serving the National Strategy

In response to General Secretary Xi's great call of "vigorously developing agricultural science and technology, and putting science and technology wings on agriculture", the related research on basic theories and common key technologies such as accurate perception, intelligent control and unmanned driving based on artificial intelligence is carried out, including the development of intelligent agricultural machinery equipment and agricultural robot systems to serve the national strategy of rural revitalization and poverty alleviation.





- Intelligent cotton picker
- Orchard robot
- Autonomous robots
- Swarm robots
- Self-driving technology
- etc



Autonomous robot (weeding, spraying)



Intelligent agricultural machinery



Picking robot



Objects: Cultivate the elites who possess the characteristics such as solid professional knowledge, outstanding capability, international perspective, humanistic feelings, innovative and down-to-earth spirit, etc.

Cultivation mode and characteristics : Explore the "trinity" talent training mode with PBL's knowledge imparting, ability training of scientific research and competition, and ideological and political education expanding, which is characterized by the cultivation method of "science innovation competition + enterprise practice + international joint training".

8+1 Undergraduate Majors:

- Electrical Engineering and Automation
- > Automation
- Intelligent Manufacturing Engineering
- Mechanical Design, Manufacturing and Automation
- Mechatronic Engineering
- Measurement and Control Technology and Instruments
- Industrial Engineering
- Industrial Design
- Robotics Engineering (approved in 2021)





- National first-class undergraduate major construction: "Mechanical design, manufacturing and automation", "Mechatronic Engineering" and "Electrical Engineering and Automation";
- Professional engineering certification: "measurement and control technology and instruments" is approved. The two majors of "automation" and "electrical engineering and automation" are under the evaluation for the 2020 engineering education certification;
- New breakthroughs in provincial and ministerial level teaching projects: 1 Shanghai off-campus practice base (15 in total), 1 special study project on employment and entrepreneurship in Shanghai (20 in total), 1 educational reform project in Shanghai, 3 key courses in Shanghai ;
- Published three "Thirteenth Five-Year Plan" textbooks: <Mechanical Engineering Testing Technology> in the "Thirteenth Five-Year" national key publishing plan project; <Robot control technology> and <3D modeling and engineering drawing> as the "Thirteenth Five-Year" General Higher Education Plan Textbooks.

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11	上海健康医学院	高质量医药研发实验室人才培训基地	徐一新	8万/年			
12	上海大学	上海发那科 -上海大学机自院智能制造人才 发展产学研基地	刘田兰	8万/年	No. 62027024200 2000 000 000 000 000 000 000 000 000		
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Innovation Competition of College Students

Undergraduate subject competition, 157 provincial and ministerial awards (71 international and national awards)

- National College Mechanical Innovation
 Competition
- National Undergraduate Engineering
 Training in Integration Ability Competition
- RoboMaster
- 15 special prizes and first prizes in China Robot Competition and RoboCup China













Graduate Teaching Achievements

Taking full advantages of disciplines, and nurturing students with scientific research

- Best doctoral dissertation award and best paper award of Shanghai Automation Society in 2020
- Excellent doctoral dissertation award of China Electronics Society in 2019
- Excellent doctoral dissertation award of China simulation society in 2020
- Excellent doctoral dissertation nomination of China instrumentation society in 2020
- 119 winners of China graduate mathematical modeling contest, including one first prize
- Host the East China competition of robot track in 2020 Digital China Innovation Competition, won three first prizes
- Two second prizes of China graduate electronic design competition







- The cooperative relationships with more than 100 enterprises are established; A joint network of practice bases including 3 Shanghai municipal undergraduate and graduate joint training bases is created; the enterprise scholarships reach a total of 2 million Yuan per year.
- The graduated students are mainly employed by global famous companies, or continue to study in well-known universities such as Imperial College London, University of Pennsylvania, University of Toronto, Purdue University, University of Sydney, Tsinghua University, Zhejiang University, Shanghai Jiaotong University, Fudan University, and Tongji University, etc.

Siemens	SIEMENS	Imperial College London	
Shanghai ABB	ABB	University of Pennsylvania	
Fanuc	FA&ROBOT FANUC	University of Toronto	5
Sany	A SANY	Purdue University	
Delta		University of Sydney	
Carl Zeiss	ZEISS Carl Zeiss Authorized Dealer	Tsinghua University	
Toyo Denso	東洋電装株式会社	Zhejiang University	
AirTAC	AITTAE	Shanghai Jiaotong University	
Shanghai Electric Group	◆上海电气	Fudan University	
Shanghai Institute of Instruments	S	Tongji University	



Alumni Donation

Alumni go hand in hand to promote the development of the school



An intelligent manufacturing and robot innovation laboratory (worth 10 million) was built with the donation from alumni, and the "Fang Yao Ziqiang Award" (10 million) and "Fang Zhou Ziqiang Award" (12 million) were established for rewarding outstanding teachers and students.



Recruitment and Employment

It has been awarded the first prize of Advanced Collective of Shanghai University for undergraduate enrollment promotion in 7 consecutive years

It has been awarded the title of Advanced Collective of Shanghai University for employment promotion in 6 consecutive years

Awarded the 2020 Employment Contribution Collective

1 The enrollment of undergraduate students in Hebei Province set a new record. The admission rate is ranked on the top 6.87% in 2020.



2 The employment has reached a new level. Although the employment situation is grim this year, the employment rate still reaches 93.52%.





International Conference



International Forum on Innovation and Emerging Industries Development – High-end Equipment Technology and Industry



"Mechanical and Vehicle Engineering 2035" International High-end Forum



International Conference on Energy, Materials and Photonics



International Symposium of Precision Optics and Artificial Intelligence



Symposium of China-Australia Joint Research Center for Intelligent and Networked Systems



Sino German forum sponsored by Sino German Science Center of NSFC



International Cooperation



Signed an agreement with Aachen University of Technology in Germany to establish the "Sino-German Intelligent Manufacturing and Robot Cooperation Center"

Signed "3 + 1 + 1" joint training and summer research program with the University of Queensland, Australia

Signed a joint postgraduate training agreement with
 University of Science and Technology of Sydney and
 held bilateral academic exchanges



Signed "3 + 1 + 1" joint training and summer research program with National University of Singapore Signed "3+1+1" and summer student exchange program with Queen's University of the United Kingdom

Signed "3+1+1" program and summer student exchange program with Purdue University, USA

The memorandum or cooperation agreements were signed with worldrenowned universities, including Cambridge University in the United Kingdom, Georgia Institute of Technology in the United States, Eindhoven University of Technology in the Netherlands, etc.

Ten online overseas courses have been opened, and 260 students have gone abroad and take part in overseas credit courses in 2020.



Research Teams

Research Center of Robotics Engineering and Technology

Research Center of Opto-mechanical Intelligent Detection and Equipment

Research Center of Robotics and Intelligent Design

Research Center of Intelligent Basic Parts

Research Center of Micro-Nano Engineering and Electronics Manufacturing

Research Center of New Energy Electric Drive

Research Center of Nano-Thermal Management and Detection

Research Center of Smart Sensors and Intelligent Equipment

Research Center of Intelligent Networked Automotive

Research Center of Smart Factory and Automated Production Equipment

Research Center of Micro-Nano Detection and Intelligent Control Diagnostic **Research Center of Networked Control**

Research Center of Intelligent Manufacturing Technology and Application

Research Center of Ultra-precision Photoelectric Detection and Information Display Technology

> Research Center of Electro-hydraulic Integrated Control

Research Center of Precision Engineering and Intelligent Robot

Research Center of Internet of Things

Wenling Research Institute

Research Center of Smart Grid and Intelligent Optimization

Research Center of Industrial Internet

Research Center of Special Robotics and Intelligent Equipment

Research Center of Brain Computer Engineering



Research Center of Micro-Nano Engineering and Electronics Manufacturing

The center focuses on the research of new micro-nano engineering and electronic manufacturing technology, and pays equal attention to the basic and applied research to intersect the multidisciplinary technologies. The research center pioneered the research of OLED in 1990, and found a interdisciplinary research group in 2004. Up to now, the research center has obtained distinctive achievements on AM OLED, display driving chips, flexible displays, testing methods and standard establishment.

Research directions

- New optoelectronic materials and new technology of relevant devices
- > Display chip design and system integration
- > AM OLED and future display





Self-aligning TFT exposure technology

- First Prize of Science and Technology Progress Award in 2016
- First Prize of Shanghai Technology Invention Award in 2014
- First Prize of Science and Technology Progress Award in 2013
- Over the past five years, the team has undertaken many national/provincial and ministerial projects with a total research funding of 60 million



Research platform for display devices



AM OLED display devices testing platform



Analysis and testing of materials and devices



Research Center of Robotics Engineering and Technology

The research center of robotics engineering technology has the core researchers including the national one million plan talent, the national ten thousand plan talent, the national outstanding young experts and other 40 high-end talents. Representative achievements include "Jing Hai" series unmanned surface vehicles, polar scientific research spherical robots, underwater robots, Shanghai World Expo multifunctional scanning and measuring boats, etc. The nine series of "Jing hai" unmanned surface vehicles carry out marine topography and geomorphology detection, seabed suspicious target detection, marine environment monitoring, seabed buried object detection and patrol warning in the Yellow Sea, the East China Sea, the South China Sea and the Ross Sea in Antarctica.

Research directions

- Design Theory of Marine Intelligent Carrier System
- Learning and Cooperative Control of Marine Intelligent Carrier System
- Energy Power and Task Loads of Marine Intelligent Carrier System
- > Ocean Sensor
- Combination of Medicine and Engineering















- The first national technological invention award in unmanned surface vehicles
- > The first prize of national science and technology progress in 2018
- In 2017, unmanned surface vehicles won the first prize and the second prize of Shanghai technology invention award. Previously, unmanned surface vehicles has won many awards such as Shanghai Technology Invention Award, Science and Technology Award, Special Award of China Navigation Society, and Innovation Gold Award of China Federation of Trade Unions.
- In 2018, unmanned surface vehicles took part in the post-processing task on the "Sangi" ship collision and explosion accident, providing important information for the assessment of submarine topography and geomorphology, the search for oil spill points, the estimation of oil spill volume, the coordination of sunken ship salvage and other work.
- In 2017, unmanned surface vehicles were used to conduct a comprehensive geological survey of Hainan's Sanya Bay coastal zone in the first time. From 2013 to 2017, it has been applied in the South China Sea, East China Sea and Yellow Sea for many times.
- > The members of the team received funding from the National Science Fund for Distinguished Young Scholars for two consecutive years.



Research Center of Intelligent Manufacturing Technology and Application

"Intelligent Manufacturing" as the core of "Industry 4.0" and "Made in China 2025" integrates the technologies of robotics, intelligent equipment, internet of things, cloud computing, big data, etc. Through vertical integration, end-to-end integration and horizontal integration, the intelligent CNC equipment, intelligent production process and intelligent control of enterprises have been achieved, which further improves the manufacturing level of China.

Research directions

- The artificial intelligence application in industrial production
- Intelligent technology for robots and CNC equipment
- Physical information fusion technology in production process
- Industrial internet of things and industrial big data analysis
- > Intelligent workshop/factory integration solution



- First prize of Shanghai Technology Invention Award in 2016
- First prize of Shanghai Teaching Achievements in 2013 and 2017
- Developed "International Joint R&D Center for Intelligent Technology of Advanced Manufacturing and Robotics" with Georgia Tech, Purdue University, University of Technology Sydney and RWTH Aachen University, etc.
- In the past five years, the total funding has reached 100 million yuan, and the annual per capita funding has exceeded one million. The team has cooperated with China Commercial Aircraft, Baoxin Software, Zhenhua Heavy Industry, Shanghai Electric, and Huayu Group etc. and won the special prize and the second prize of the Shanghai Industry-University-Research Cooperation Excellent Project Award in 2018 and 2019.





Research center aims at the technological frontier of artificial intelligence and unmanned systems for the National/Shanghai's strategic needs, is engaged in equipment intelligence, unmanned plant, production informatization, basic theoretical research, key technology research and engineering application practice on robots and unmanned autonomous systems, and is committed to the deep integration of artificial intelligence with intelligent manufacturing and the real economy.

Research directions

- Intelligent robot (perception, navigation, control)
- Intelligent equipment control and fault diagnosis
- Multi-robot system collaboration
- Digital twin and parallel system
- > Man-machine hybrid intelligent technology
- Intelligent agricultural machinery equipment and agricultural robots









- Intelligent equipment and agricultural robot " team won the honorary title of "Workers Vanguard" issued by Shanghai Federation of Trade Unions in 2019
- "Self-propelled three-row cotton picker" won the first prize of China Machinery Industry Science and Technology Award in 2019
- Control and intelligent maintenance platform for giant heavy-duty rotary drilling rig" won the third prize of Shanghai Science and Technology Progress Award in 2018
- 2 National Key R&D Projects, 1 "863" Program, 11 National Natural Science Foundation and more than 10 Shanghai Key Projects of Basic Research
- More than 50 papers in authoritative journals of Chinese Science, Automatica, Nonlinear Dynamics, IEEE Robotics, Automation Letters, etc.



Networked Control Research Center of Shanghai University relies on Shanghai Key Laboratory of Power Station Automation, National "111 Center" and Sino-British Joint Laboratory of Energy and Automation, and researches on international academic frontier issues such as networked control and security, machine vision, artificial intelligence and big data analysis and smart energy.

Research directions

- Advanced control theory under network environment
- Energy-saving optimization control in the energy field
- Intelligent sensing and control in the field of medical devices
- Networked R&D platform construction and engineering
- Machine vision and intelligent detection
- > Artificial intelligence and big data analysis



Remote Patrol Service Robot

Networked remote control of power generation system

- First prize of Shanghai science and technology progress award in 2018
- > 2018 Global Most Cited Researchers: Prof. Qing-long Han (IEEE Fellow) and Prof. Peng Chen
- Second prize of national science and technology progress award (cooperation) in 2016
- First prize of Chinese association of automation (cooperation) in 2017
- In the past five years, the team has undertaken more than 60 important scientific and technological projects such as national key R&D plan project, key project of National Science Foundation of China (3 times) and topics of the Ministry of Industry and Information Technology (2 times) etc. The annual funding is more than 13 million, and more than 10 books have been published. More than 150 SCI journal papers have been published, and more than 50 national invention patents have been authorized.



Research Center of Smart Sensors and Intelligent Equipment

The Lab of Smart Sensors and Intelligent Equipment of Shanghai University researches on international academic frontier issues such as smart sensors, aircraft virtual simulation and control, and artificial intelligence. The lab is equipped with the laser tracker, universal remote networked monitoring system and virtual simulation test-bench.

Research directions

- Sensors: INS, indoor positioning and ultrasound positioning
- Aircraft virtual simulation, semi-physical simulation, flight control and integrated avionics test technology
- General aviation flight simulator
- Vehicles control and equipment

- Virtual reality simulation, aircraft semi-physical simulation system, coaxial unmanned helicopter flight control system, integrated avionics test platform
- In the past three years, the team has undertaken more than 10 important scientific and technological projects such as R&D plan projects, project of National Science Foundation of China, etc. The annual funding is more than 9 million. More than 10 SCI journal papers have been published, and 3 national invention patents have been authorized.





Research Center of Energy Management and Control of Smart Grid

In view of the technological development of new energy industry, the main research areas include the construction of smart grid and the market-oriented reform of power industry in China, research on smart grid energy management and optimization control, smart grid state estimation and security risk assessment, flexible management of power system based on market mechanism and new energy absorption. It undertakes to complete a large number of national and provincial and ministerial research projects, as well as engineering application projects, and has won many scientific and technological awards, including Shanghai Science and Technology Progress Award, Shanghai Natural Science Award, etc. It has advantages and characteristics in the research direction of power market transaction mechanism design and risk management, smart grid energy optimization control, etc.

Research directions

- Energy router based coordination control and energy management of smart microgrid
- New intelligent optimization methods based optimal dispatching of smart grid
- Design, game analysis and risk management of power market transaction mechanism
- Market mechanism based power system flexibility management and new energy consumption
- Smart grid state estimation and security risk assessment under hybrid network attacks
- Heterogeneous unit combination considering wind power and electric vehicle collaborative grid connection



- The multi-energy E-router based intelligent distributed energy network with three-tier tree architecture is studied. The system architecture, control scheduling strategy and the technology type and implementation method of key component E-router are given. The energy management and control system of SST-based intelligent microgrid based is realized.
- The game equilibrium theory of complex electricity market based on nonlinear complementarity theory and distributed algorithm is developed. The flexible management and new energy absorption mode of power system based on market mechanism are studied. The information asymmetry problem of electricity market based on mechanism design theory is solved.
- A stochastic optimal power flow model and security analysis method based on the non-linear complementary function and subdifferential method are proposed, and a security early warning and control decision system for wind power grid-connected power system under multi-operation mode is established.
- The key theory and technology of intelligent optimization algorithms such as particle swarm optimization, differential evolution and artificial bee colony are proposed to solve the scheduling problem of smart grid, and a series of novel and efficient optimal scheduling methods are formed.
- In the past three years, the team has undertaken more than 10 projects of National Science Foundation of China, etc. More than 150 SCI papers have been published, with 9 ESI high cited papers. Be awarded by the first prize of the Ministry of Education Natural Science Award, Shanghai Science and Technology Progress Award, etc.



Research Center of Robotics and Intelligent Design

The Research Center of Robotics and Intelligent Design of Shanghai University focuses on the areas of robot, aerospace equipment, marine engineering equipment, high-grade CNC, intelligent agricultural equipment, new generation of industrial information technology, and other significant demands of China and Shanghai.

Research directions

- Intelligent robot technology
- > Sustainable intelligent design technology
- > Artificial intelligence and big data analysis
- Intelligent manufacturing system technology



The World's Largest Offshore Wind Power Installation Platform



Aircraft Big Data Quality Analysis System Based on Digital Twins

- The world's largest offshore wind power installation platform
- China's first and the world's second largest servo cold heading machine tool
- China's first large-scale satellite antenna in-orbit assembly robot
- The first domestic large-scale satellite antenna assembly robot in orbit
- Intelligent rehabilitation robot
- Manufacturing execution system for equipment manufacturing such as aircraft, glass, and energy, etc.
- Aircraft big data quality analysis system based on digital twins
- Information fusion system for marine engineering equipment
- Unmanned intelligent mobile robot in complex unstructured environment



Research Center of Special Robotics and Intelligent Equipment

The Research Center of Special Robotics and Intelligent Equipment relies on the national key disciplines of "Mechanical Engineering" and "Mechatronic Engineering", and focuses on special technologies such as special robots, medical robots, humanoid/bionic robots, electro-hydraulic intelligent equipment. Various long-term cooperative relationships have been established with well-known domestic universities, hospitals and research institutes. The team with more than 10 members aims to break through the key technologies of robots and intelligent equipment, and strive to become one of the bases for discipline construction, scientific research and talent cultivation at Shanghai University.



Research directions

- Special robot technology
- Intelligent humanoid/bionic robot
- Medical robot
- Intelligent unmanned system
- > Machine vision and intelligent detection
- Electromechanical and hydraulic integrated intelligent equipment

- In the past five years, the team has undertaken 3 national projects, more than 30 industrial projects, published 20+ SCI papers, authorized 80+ national invention patents and won Shanghai Award once.
- > In 2018, the funds exceeded 14 million yuan.
- Supervised more than 20 Ph.D students, 100 master students, and 6 post-doctors.



Research Center of Smart Factory and Automation Equipment

The Research Center of Smart Factory and Automation Equipment, relying on the national key discipline "Mechatronics", starts from the realization needs of smart factories, actively combines artificial intelligence, big data and cloud computing with technical research and implementation of automation equipment based on network, digital and intellectualization, and provides practical solutions and project implementation for industrial applications.

Research directions

- Industrial Robot Application
- > Automation Equipment for Smart Factory
- Medical Equipment for Orthopedics



Robot Palletizing and Demolition system



Featured achievements

- Team members have built a lot of automated production lines for automobile and tobacco enterprises, achieved good economic benefits.
- > Team members have worked with a number of hospitals to develop equipment for orthopedics.



Automotive Filter Automatic Assembly and Detection Line

Robot Automatic Unpacking Production Line



Robot Rummaging system



Research Center of New Energy Electric Drive

The Research Center of New Energy Electric Drive conducts research on new energy and electric drive technologies, including high-efficiency permanent magnet motors, intelligent motion control and energy management and core technology of general servo system, advanced integration of power electronics and efficient packaging of power units, global intelligent optimization management and implementation of "distributed source-load-storage energy" microgrids, etc. It has first-class simulation platform of electric drive design and platform of measurement and control.

Research directions

- Power electronic transformation, advanced drive and motion Control
- Electric machines and electric apparatus, new energy automotive powertrain, servo systems
- Power system and automation, microgrid and distributed energy
- Theory and new technology of electrical engineering based on new principles and new materials
- Electrical system intelligence and application, mobile equipment intelligent technology



- The first prize of Shanghai science and technology progress award for "Development of High Density Permanent Magnet Motor and Its Control System for Electric Vehicle"
- The third prize of Shanghai science and technology progress award for "Research and Application of Key Technologies for Mine-used Storage Battery Electric Locomotive"
- The team has undertaken 16 National 863 Programs and Key R&D Programs in the past 5 years (as the project leader). There have been over 37 millions of government sponsored research funds in the past five years, including 18.701 millions of state-level research funds
- The team has published 14 high-quality SCI papers, including 7 high-cited (ESI) papers in IEEE Transactions on Power Systems, 27 papers in the first-level journal of electrical engineering and 11 monographs (including 2 monographs in Springer, 2 monographs in Science Press), in the past 5 years.



Research Center of Micro-nano Detection and Intelligent Control Diagnostic

The development trends facing the national equipment manufacturing industry today are making upgrades with unmanned technology and intelligent design improvement. Shanghai University's research leads in these trends, with advancements in precision electromechanical equipment and intelligent robots. The current areas of research and development are focused on improved fault diagnosis, electromechanical precision equipment, intelligent structure, micro-nano robots, multi-robot system development, and intelligent humanoid/bionic robots.

Research directions

- > Abnormal detection and online fault diagnosis for complex equipment
- Numerical simulation platform for oil well pipe joints under complex loads
- > Control and application of intelligent robots
- Application and development of micro-nano robots
- Highly sensitive giant magneto-impedance sensor











- Aiming at the problems such as complicated fault mechanism, lack of fault samples, and difficulty in detection by traditional state detection and fault diagnosis methods of complicated equipment such as large reciprocating compressor, the research on the mechanism of large-scale reciprocating compressor crosshead sinking is carried out.
- Created an intelligent mechanism, comparable to the human immune system, designed to swiftly detect and diagnose any fault within a complex system of equipment.
- A numerical simulation platform has been developed to reduce the risk of pipe joints failures under complex loads.
- Involved in more than 10 national and provincial level projects, 1 YangFan plan, 16 SCI papers, and more than 10 patents were authorized in 2018.
- The University so far has won both the 2nd and 3rd prizes of the Shanghai Technology Invention Award.



Wenling Research Institute

The Wenling Research Institute, an institution established by the School of Mechatronic Engineering and Automation in cooperation with the Wenling Municipal Government to enter the Technology Innovation Service Center of Wenling City, promotes the transformation of scientific and technological achievements, the upgrading of traditional industries and the cultivation of emerging industries. Aiming at the pillar industries of Wenling City which include the pump and the motor, automation equipment, machine tools, automobile and motorcycle parts, pneumatic tools, etc., the institute is devoted to research, technology development and services in special motor and its control, vane pump fluid analysis, industrial automation, variable-frequency driver and servo driver, test equipment, big data management and mining, etc.

Research directions

- > Design and control of special electrical motor. variable-frequency driver and servo driver
- Analysis and design of vane pump fluid
- and information. > industrial automation data acquisition system, big data management and mining
- > Power electronics converter and equipment, modular power system
- Test and measurement equipment





72Nm stator and rotor of permanent magnet torque motor



New compound pump motor and controller



High-speed motor and controller for marine gyro-stabilizer



Power lithium battery formation system



Car seat part product quality inspection system based on image processing

- > Design and development of low-speed large-torque direct-drive motor, PM brushless DC motor, permanent magnet synchronous motor, bearingless PM motor, etc.
- > High efficiency and performance motor driver, variablefrequency driver and servo driver
- > Design and development of intelligent automation system
- Industrial detecting system
- Cloud-based data acquisition system. management system and big data mining
- \succ High efficiency, high performance, large capacity and modular power system
- > Research on new energy storage and its transformation and control technology, research on key technology of battery cascade recycling lithium ion and its industrialization technology
- In the past three years, the team has undertaken nearly 7 million yuan of enterprise projects.



Research Center of Brain Computer Engineering

Relying on first-class disciplines (combination of medicine and engineering), plateau disciplines (control science and engineering) and first-level disciplines (instrument science and technology), the Research Center of Brain Computer Engineering conducts research on the core technologies of brain-computer interaction and its international academic frontiers in engineering applications in medical rehabilitation and defense. The research includes intent decoding technology based on bioelectrical signals such as EEG, EMG and eye movement, virtual reality simulation training technology, diagnostic rehabilitation techniques for diseases such as stroke and depression, physiological data collection, emotion and body recognition technologies, etc.

Research directions

- Intelligent decoding theory of bioelectric signals such as EEG/EMG
- Human-computer interaction technology based on signals such as EEG/EMG
- Virtual reality rehabilitation training and simulation control technology
- Stroke rehabilitation with brain-computer interaction combined with virtual reality
- Automatic diagnosis and rehabilitation of patients with depression
- Drug addition assessment and brainwave training for drug addicts
- Physiological data acquisition technology
- Emotion and body recognition technology
- Design and integration technology of health care robot
- Environment perception and location technology in complex scenes
- Intelligent artificial organ
- Medical big data artificial intelligence decision

Featured achievements

- ➢ The developed "Brain-computer interface rehabilitation training system" is a representative product of brain-computer interface technology in the enterprise to achieve the transformation of results. The product obtained medical registration certificate, was used in more than 50 well-known hospitals in China, and added into the health insurance system.
- Director of the research center was awarded the Shanghai May 1st labor medal.
- The team won the third prize in the "2015 China Brain Machine Interface Competition (Robot Control)" hosted by the National Natural Science Foundation of China.
- Co-host of 2019 and 2020 world robot contest -- brain-controlled robot contest and the team won the third prize in 2019.
- In the past five years, the team has undertaken nearly 20 projects, including the National Key R&D Program of China, the Nation Science Foundation Project, national defense projects, key projects of Shanghai Science and Technology Commission, and enterprise projects, with more than 15 million funds and more than 50 academic papers.







itationEEG/EMG RemoteVRControl System

Brain-computer interactive rehabilitation training system combined with VR



Research Center of Intelligent Basic Parts

The Research Center of Intelligent Basic Parts conducts research on international academic frontier issues such as industrial basic components and related technical units, etc. The center are focused on the intellectualization of industrial basic, tribology and mechanical system dynamics, and modern testing technology. The related research results has been extended to industrial applications.

Research directions

- Research on dynamic characteristics testing technology and stability of sliding bearings
- Tribologic characteristics, dynamic characteristics, online monitoring and life prediction technology of rolling bearings
- Self-lubricating bearing design, materials and processing technology
- High-speed rotor dynamics and high-speed electric spindle technology
- Artificial joint technique with the combination of medical science with engineering





Core technology of high-end sliding bearing

- Developed calculation methods for static and dynamic characteristics of more than 20 kinds of radial bearings and thrust bearings with different structures and engineering applications
- Developed a multi-parameter adjustable dynamic characteristic test bench of radial bearing and thrust bearing to obtain parameters such as bearing stiffness and damping
- Research on friction performance optimization of rolling bearings under special working conditions with SKF Netherlands R&D Center and SKF Global Technology Center
- Provided domestic technical support for basic components such as sliding bearings for enterprises in more than 60 pillar industries of the national economy.
- Research on high-performance electric spindle system technology and product development, forming a mature design and bringing it to market

Static and dynamic characteristics test bench of sliding bearing



Research Center of Nano-Thermal Management and Detection

The research center of nano-thermal management and detection has been devoted to the research of nano-electronic materials and micro-nano integrated packaging technology, the applications of nano-materials in the thermal management of electronic products and other fields, especially on the preparation and characterization of advanced packaging materials of carbon-based nano-materials, the applications of nano-materials in the heat dissipation of electronic devices, and the detection and simulation of heat dissipation of electronic products.

Research directions

- Application of graphene for the thermal management of high power electronic packaging
- Application of carbon nanotubes in through silicon via (TSV) and interconnection of 3D chips
- Study on the thermal and mechanical properties of new thermal interface materials (TIMs)
- > Biocompatibility of graphene oxide coatings





- The fabrication of graphene by chemical vapor deposition and the transfer of graphene to thermal test chips were performed to meet the urgent needs of the thermal management of high power devices.
- The applications of graphene heat spreaders for the thermal management of electronic devices with different packaging structures was studied, and the functionalized graphene to form surface bonding with silicon dioxide and other target devices, so as to improve the heat dissipation effect.
- Carbon nanotubes were used in through silicon via (TSV) and interconnection of 3D chips. The densification methods of CNTs with different configurations and volumetric ratios are experimentally studied.
- The research and development of metal-based nano-TIMs. A systematically study has been conducted of the nano-TIMs in term of the thickness, hotspot location and heat dissipation effect and the reliability such as fracture strength.



Research Center of Intelligent Network Automotive

Research Center focuses on the commonalities and key technical issues of the new generation of vehicles that are safe, comfortable, energy-saving and efficient. By giving full play to the interdisciplinary advantages, the research on core components, algorithms and application is carried out based on the basic foresight and key application technologies, such as environment perception, intelligent decision-making, cooperative control and electric drive.

Research directions

- Environment perception technology and sensor chip design and application
- > Autonomous intelligent control and networked collaborative control
- > Traction motor design and motor noise and vibration
- > High-reliability and high-performance motor drive controller
- Battery management and vehicle management system development

- Intelligent control and management platform of electric vehicle for "Internet +" won the first prize of Science and Technology of China Instrument and Control Society (the first accomplisher) in 2015
- Self-sensing method for energy system load change won the best paper award of IEEE International Conference on Information and Automation in 2012
- Vehicle skid and control simulation platform, won 2017 IEEE ICIA best paper award
- High-power motor and drive controller for vehicle form industrial application, which has been applied to medium bus, electric logistics vehicle and city bus



Road skid - driving environment self-sensing system



Industrial motor drive controller



High power bus motor



Research Center of Industrial Internet

Research Center of Industrial Internet, relying on the academic platform such as Shanghai Key Laboratory of Intelligent Manufacturing and Robotics and Shanghai Robot Association, guided by the country's "two integrations" and "smart manufacturing 2025" strategies, focuses on the development needs of the factory for digitization, networking and intelligence, and studies the core issues such as Internet of Things, big data, industrial cloud and artificial intelligence.

Research Direction

- Intelligent monitoring of equipment based on heterogeneous ad hoc network
- > Workshop control network and information integration
- Robots and artificial intelligence
- > Digital factory
- Big data and cloud manufacturing
- Additional manufacturing and 3d printing technology



Housekeeper System of Machine Tool Based on Industrial Internet

數控装备状态跟踪及远程诊 Furnace Remote Monitoring System

State Tracking and Remote **Diagnosis System for NC** Equipment

Monitoring System of Intelligent Distributed Photovoltaic Power Station

Featured Achievements

> Over the past five years, the team has undertaken more than 70 national, provincial and industrial projects, published more than 100 SCI/EI journal papers and authorized more than 50 national patents.



Precision Bearing Manufacturing Digital Workshop and MES System



Automatic Production System for Cigarette Packs

Big Data Application System for Improving Aircraft Development Capability



Central Air-Conditioning Centralized Control and Remote Monitoring System





Research Center of Optical Electromechanical Intelligent Detection and Equipment

The Research Center of Optical Electromechanical Intelligent Detection and Equipment is mainly for deep sea, deep space, automotive, old / disabled helping, intelligent robots, intelligent manufacturing and other fields, carrying out theoretical and applied research on optoelectronic intelligent detection, opto-electro-mechanical equipment and system integration, machine perception and intelligence, human machine intelligence enhanced fusion and other aspects.

Research directions

- > Machine vision underwater imaging theory and technology
- Light field imaging theory and technology
- Machine vision 3D imaging and information processing
- > Robot environment perception, path planning and navigation
- Human-machine interaction and human-machine intelligence enhanced integration
- > Opto-electro-mechanical system integration and equipment



Laser high-speed line scanning 3D biometric system

Driver - vehicle intelligent interaction and cooperation

- Laser synchronous scanning triangulation imaging system provides position and attitude information for spacecraft tracking and dock
- High speed laser scanning binocular vision threedimensional measurement and low light level camera image processing technology provide means for in-situ digital observation of deep-sea organisms
- The application of robot human interaction and intelligent enhancement fusion theory and system in the field of helping the aged / disabled
- The driver vehicle intelligent interactive cooperation technology based on human vision / voice and other natural channels provides technical support for the realization of intelligent networked vehicle and intelligent driving
- In the past five years, the team has undertaken one national key R & D plan program and two projects; undertaken more than 10 National Natural Science Foundation projects, major projects entrusted by enterprises and institutions, published more than 30 papers in SCI / El mainstream journals, and authorized more than 10 national invention patents.



Research Center of Precise Engineering & Intelligent Robotics

The Research Center of Precise Engineering & Intelligent Robotics performs research related to precise engineering, medical engineering, robotics, artificial intelligence, industry 4.0. The center was founded in 2000 by Prof. Qian Jinwu. It is part of the Department of Precision Mechanical Engineering at Shanghai University.

Research directions

- Design and Control of Final Optics Assembly of ICF
- Magnetic Fluid Deformable Mirror
- > Adaptive Tracking Control for Optical Data Storage Systems
- > Reconstruction of Distorted Underwater Images
- > Hand & Eye-vergence Visual Servoing













Research Center of Electro-hydraulic Integrated Control

The Research Center of Electro-hydraulic Integrated Control has established an alliance of industry, academia and research with many well-known enterprises in the field of hydraulic engineering at home and abroad, focusing on the frontier issues of intelligent control and intelligent detection of hydraulic components and electro-hydraulic systems. The center are equipped with a visual modeling based control system development platform, including hydraulic component performance test bench, capsule accumulator performance test system, and energy-saving electro-hydraulic car brake test system.

Research directions

- Development and preparation of electromechanical and hydraulic intelligent measurement and control system
- Design, simulation and preparation of special-use hydraulic system
- Industrial and hydraulic energy saving control
- Complex system modeling control





Device of high-efficiency energysaving hydraulic component measurement and control series





Electro-hydraulic Measurement and Control System Based on Labview/VB/C++

- Researcher Xing Keli and Professor Liu Tingzhang in the team are well-known domestic experts in the field of hydraulics and control
- Development of Mechatro-Electro-Hydraulic Measurement and Control System in recent 20 years
- Rich experience in research and development of nonstandard hydraulic measurement and control equipment
- More than 200 sets of high-efficiency and energy-saving hydraulic component measurement and control devices have been successfully developed, which have been well applied in more than 30 enterprises at home and abroad, and have a certain popularity.
- In the past five years, the team has undertaken more than 30 major scientific and technological projects with a total expenditure of about 20 million yuan, published 6 books, published more than 60 papers in SCI mainstream journals, and been authorized more than 20 national invention patents.



Research Center of Ultra-Precision Optoelectronic Metrology and Information Display Technology

Ultra-Precision Optoelectronic Metrology and Information Display Technology Research Center researches on ultra-precision photoelectric detection and true 3D virtual reality display, etc. Many of the research results are internationally advanced, such as non-destructive testing of large-size ultra-precision optics and real-time dynamic holographic 3D video display, etc.

Research directions

- Precision optical inspection and optical system design
- > Micro-nano optical imaging and precision inspection
- Computational imaging and 3D display
- Holographic light cloning 3D display and virtual reality intelligent display
- > Computer vision and artificial intelligence
- Optical fiber sensing system and aviation structure testing technology
- > Intelligent structure and active control
- Micro-nano operation and precision system

Research directions

- Published more than 80 SCI papers and 1 monograph in the past 5 years;
- In the past 5 years, 3 national key research and development projects and 1 NSFC key project have been approved.

















The research center of visual learning and data science, relying on the national 111 talent introduction base, the first-class discipline of combination of medical and engineering, the control science and engineering, and the Shanghai plateau discipline, carries out the research work of academic cutting-edge technologies and methods in the direction of computer vision, visual learning, data statistical analysis, machine learning, deep learning, human-computer interaction, etc.

The Research Direction

- > Visual multiplayer localization method and data analysis
- Dynamic human visual data recognition and localization analysis
- > Visual cognition of multi-target human movements
- Dynamic obstacle avoidance of manipulator based on visual perception
- Robot relocation based on deep learning
- Multi-object grabbing platform of robot arm based on vision
- Manipulator anthropomorphic motion planning based on reinforcement learning
- Dish visual recognition based on multi-level learning model



Visual multiplayer tracking system



Monocular vision positioning system

Characteristic Results



Multi-object visual recognition and grasping platform of robot arm



Dynamic obstacle avoidance system of manipulator based on visual perception



Visual human motion recognition system



Research Center of Visual Sensing and Intelligent Equipment

Key technologies and breakthroughs of 3D sensors

- Breakthrough the bottleneck of high frame rate transmission of 3D images under high resolution
- Realize the intelligent real-time processing technology of 3D image embedded on board



Core module of 3D imaging sensor

3D intelligent camera

3D imaging

Application field : Space positioning, robot navigation, automatic driving unmanned car, industrial production,

medical field, intelligent robot navigation in the epidemic situation

Key technology and breakthrough of 2D vision software

- Breakthrough the detection of tiny defects in complex background
- Propose the small sample generalization learning algorithm
- Realize high-speed online accurate detection technology







High-speed visual asepsis testing system for aluminum-plastic composite cover of medical package

High speed visual sorting system for cork

Intelligent high-speed vision detection production line

In the epidemic, it has been used in 28 pharmaceutical manufacturers such as Yantai Xinhui, Weihai Weigao, Zhejiang Zhouqing, Chongqing Zhengchuan and Hubei Yinhua

Application field : Intelligent manufacturing, aerospace, medical, agriculture, mining, clothing, food...



- Since 1980s, a number of disciplines have been developed under the national and Shanghai government's support;
- During the "10th Five-Year Plan" period, Mechatronic Engineering was listed as one of the first Shanghai municipal key disciplines. Advanced Robot Technology and Modern Manufacturing System, Electronic Instrument Automation were listed in the second batch of Shanghai key advanced disciplines and special disciplines, respectively;
- Advanced Manufacturing and Automation was listed in the national "9-11th Five-Year Plan" and "211 Project" key disciplines for three consecutive times since 1998;
- During the period of "11th Five-Year Plan", the Optimization and Control Technology of Energy Engineering was listed as one of the three major development directions in the national "211 Project" key discipline - "Energy Engineering and New Technology";
- The "Urban public security and advanced technology and equipment" was listed as the subproject of "Urban society and smart city" - the "12th Five-Year Plan" connotation construction program in Shanghai local universities;
- Mechatronic Engineering was listed in the national key disciplines in 2001;
- Mechanical Engineering was listed in the first-class disciplines of Shanghai in 2012 and has undertaken the national task of building a world-class discipline since 2016.



General Situation of Disciplines

In the 2020 Global ranking of academic subjects of Academic Ranking of World Universities (ARWU), all four first-level disciplines in the school are ranked in the top 300 list

2020 Global ranking of academic subjects in Academic Ranking of World Universities				
101-150	151-200	201-300		
Instrument Science	Mechanical Engineering	Power Electronics Engineering		
	Control Science and Engineering			





Construction of International Top-ranking Discipline of Combination of Medicine and Engineering - Wisdom Diagnosis



An in vitro precise separation system has been successfully developed for cancer cell based on robot automation and computer vision technology.



Construction of International Top-ranking Discipline - Precision Medicine

Complete more than 100 clinical trials in dozens of hospitals, such as Xuhui Hospital and Changzheng Hospital of Fudan University, helping patients with radial mental injuries, fibula fractures, wrist fractures and stroke patients.



In the prevention of coronary pneumonia, a series of protective equipment for severe infectious diseases such as goggles, combined face shields, and intubation isolation negative pressure hoods were quickly developed, which were freely open to social technology and supported medical staff.





Construction of International Top-ranking Discipline of Combination of **Medicine and Engineering - Active Rehabilitation**



Research and industrialization of the key technologies of the new generation intelligent lower limb rehabilitation robot iRego



2018年7月30日 屋棚 旗林藏 www.ifdaily.com ★编, 唐荷茗 编辑, 用译 实习生, 夏兰

上海机器人产业技术研究院聚焦可靠性、智能化共性技术,打通原理样机到产品转化之路

康复机器人有望平民价进入患者家

■本将记者 俞崩伏 最近,上海大学教授郭帅带队研发的助行 康复机器人"iReGo"进入了医疗器械注册流 程,未来有望以"平民价"进入脑卒中患者家庭 和康复机构。"如果没有上海机器人产业技术 研究院的支持 康复机器人的产业化进程不会 这么快。"他感慨地说。上海机器人产业技术研 究院是市政府布局的研发与转化功能型平台 之一,聚焦机器人的可靠性,智能化共性技术 为高校、科研院所、企业的机器人开发提供技 术支撑 今年,郭帅还有了一个新头衔——上海机

器人产业技术研究院副院长。他一周5天到研 究院工作,希望把国内高校和科研院所的一大 批机器人研发成果吸引到功能型平台,打通从 原理样机到产品的转化之路。

非营利企业处处"不一样"

市科委基地处处长谭瑞琮介绍,推进研发 与转化功能型平台建设,是构筑上海科创中心 "四梁八柱"的重要内容。今年1月,市政府发 布(关于本市推进研发与转化功能型平台建设 的实施意见》。4月,市科委联合相关部门发布 《上海市研发与转化功能型平台管理办法(试

行)》。"作为新型研发机构,研发与转化功能型 平台已成为上海科技体制创新的试验用 它们 的功能定位包括三方面支撑, 朋支撑产业链创 新、支撑重大产品研发转化、支撑创新创业。 去年12月,上海电器科学研究所(集团) 有限公司、上海大学、普陀区政府联合出资成 立上海机器人产业技术研究院,"这个研究院 是企业,但和大多数企业不一样,它属于非营 利机构,不进行分红。"上海机器人产业技术研 究院院长郑军奇说,"研究院的口号是:我们不 -样。

。 除了是非营利机构外,这一研发与转化项 能型平台与大多数企业相比,还有不少"不一 样"之外,例如研究院的大量资金来自市政府 财政经费,用于购置装备,建设机器人可靠性和 智能化两大平台。很多装备的单台售价都以千 万元计,国内机器人中小企业大多无力购买,而 研究院的研发平台建成后,可以较低收费让中 小企业使用并提供技术服务,使它们的机器人 产品拥有更健康的身体、更智慧的头脑。

又如,研究院的员工分为5类;全职在职 全职聘用、顾问专家、兼职人员和合作研究员。 郑军奇说,他以前在上海电科集团工作,现在 属于研究院的全职在职员工。郭帅以前是上海 大学教授,现在保留上大教师岗位,被研究院

全职聘用。研究院聘请了国内外机器人领域的 器械、上市前要经过国家药路局指定单位的产 一批知名专家,组成顾问专家团队;还聘请了 格检测,所以提前发现问题,让上大科研人员感 一批中書年骨干研发人员担任兼职或合作研 到庆幸,"如果药临局指定单位检测出问题,我 究员、参与研究院的科研项目。

们再返工,就会影响医疗器械注册的进度," 除了可靠性,智能化也是机器人研发与转 第四代 iReGo 将亮相今年工博会 化功能型平台的聚焦点。根据计划,智能化技

这种制度设计,让郭帅尝到了甜头。"以前 术研究平台分为智能成知 智能操控 云處智 在高校,我和市场接触的机会不多,虽然研制 能三个子平台,目前正在建设中。利用已初具 出三代助行康复机器人的样机,但总觉得离产 规模的云端智能子平台,有更多智慧功能的第 业化还有一点距离。"今年初,他把"iReGo"带 四代"iRaCa"即这同世 这高相公在工作合 它 到研究院,让可靠性团队的研发人员"把脉" 们进入多家康复机构后,某台机器人一旦积累 结果发现在可靠性上有不少问题。上海机器人 了针对某一类型康复患者的训练策略,其它相 产业技术研究院常务副院长黄慧洁表示,国内 器人能通过云平台进行学习。这样一来,机器 高校,中小企业研发机器人时,注重的往往最 人群体就能高效地获取康复训练经验。 功能和外观,而忽视可靠性检测和相关技术。 作为研究院副院长,郭帅希望机器人研 其实,机器人产品全生命周期的可靠性非常重 要,是决定产品能否得到市场认可的关键因素 シー、上海由科集団设有国家机器人检测与逐

发与转化功能型平台能让更多的高校科研人 员受益。在他的张罗下,上海机器人产业技术 研究院已与上海交通大学 同济大学 上海大 学、北京航空航天大学、中山大学等国内多所 高校建立联系,有望将越来越多的机器人原 理样机转化为高质量产品"对于高校研究的 原理样机,投资人常常不感兴趣,觉得离产品

产品化服务,从实验室到市场的这段路前

经过全身"体检","iReGo"的一些硬件和软 还有一段距离。现在有了功能型平台的工程 件漏洞暴露出来, 郭帅团队立即与可靠性团队 商讨提升方案,这种助行康复机器人属于医疗 会暗畅很多.

定中心,可以为各种机器人提供机械、电气、电

磁安全等10多项检测服务。在此基础上,上海

机器人产业技术研究院能为客户制定产品可

靠性提升方案。





Research and industrialization of key technologies for intelligent upper limb dual-arm rehabilitation robot



Construction of International Top-ranking Discipline of Combination of Medicine and Engineering - Active Rehabilitation

The development of brain computer interactive rehabilitation medical equipment



Support enterprises to obtain the first medical registration certificate of brain-computer interaction field in China. It has been used in more than 50 hospitals, such as Beijing Tiantan hospital, Chinese PLA general hospital, Shandong provincial hospital and the Second Rehabilitation Hospital (Shanghai). Some provinces have added it into the health insurance system. In April 2020, the work was introduced in CCTV-9 program "AI dream" for 15 minutes.



Construction of the First-class Discipline of the Ministry of Education - Intelligent Transport Science and Engineering

Construction goal: To solve the core scientific problems and key technologies of the marine intelligent carrier systems, to make breakthroughs in the development of the marine equipment, and to serve the national strategy of maritime power, military and civilian integration, and the Belt and Road Initiative.







Construction of Shanghai Plateau Discipline-Mechanical Engineering

The direction and key tasks of the plateau discipline construction are chosen based on the major national demands.







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