

Siyuan Chen

Scopus, Google Scholar
HomePage

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School of Automation Science and Engineering in South China University of Technology

Research Interest: Intelligent Robots; Neural Network; Human-Computer Interaction; Control System

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SUMMARY

Siyuan Chen is currently working toward the Ph.D. degree in control science and engineering with the School of Automation Science and Engineering in SCUT. He were involved several projects as principle leader and pursued research works in the field of neural networks, robots and optimal control. He published 13 SCI papers and obtained 5 China authorized patents. He won many honors and awards including Ph.D. National Scholarship, President Scholarship of SCUT, and the 14th "Challenge Cup" Special prize.

EDUCATION

- **South China University of Technology (SCUT)** Guangzhou, China
COMBINED MASTER-DOCTOR'S DEGREE PROGRAM (2+3) in *Control Science and Engineering* Sep. 2019 - Jun. 2022
Supervisor: Prof. Zhijun Zhang & Co-Supervisor: Prof. Zhuliang Yu
- **South China University of Technology (SCUT)** Guangzhou, China
BACHELOR in *Automation Science and Engineering* Sep. 2013 - Jun. 2017

RESEARCH WORKS

- **Motion Planning Strategies for Redundant Robots:** To improve the performance of redundant robots, several novel optimal criteria, functional criteria and motion planning schemes are designed. In detail, several optimal criteria are proposed to improved the adaptability of the redundant robots, such as maximum manipulability criterion, repetitive motion criterion and minimum velocity norm criterion; several novel functional criteria are designed to enhance the functional abilities of the redundant robots, such as obstacle avoidance criterion and end-effector posture maintaining criterion; to take full advantage of the flexibility of redundant robots, several hybrid schemes consisted of multi criteria are also investigated for redundant robots which are expect to accomplish different tasks in complex surrounding.
- **Neurodynamics based Solvers:** The neurodynamics is used to solve the time-varying problems especially matrix equation rapidly. By introducing time-varying gain to the original neurodynamic method, the robustness and convergence are improved greatly. Through this method, the function error will converge to zero quickly even when noise exists. Inspired by the integral arithmetic of PID control theory, the integral of function error is considered in the proposed modified Zeroing Neural Network to obtain finite-time convergence and great tolerance to noise. Finally, the neurodynamics based Solver obtains the resistance to random periodic noise by insetting the additional compensation term into neurodynamic equation.
- **Signal Processing and Pattern Recognition:** To improve the effectiveness of the sampling signal, the preprocessing is important and significant. The sensitive electroencephalograms (EEG) sampled from electrodes distributed on the human head have to be filtered before being input to classifier. To recognize the user's intention quickly, the Bayes classifier is employed to capture the P300 event-related brain potential, in which the user is able to send the control order to the computer online.

PROJECT EXPERIENCES

Intelligent Redundant Manipulators

Principal Leader, *Bionic Intelligent Robot (BIR) Lab*

Jan 2016 - Present

Advisor: Prof. Zhijun Zhang

- Designed and developed a redundant robot manipulator consisted of three large size modular-design joints and three small size modular-design joints, and controlled through CANopen, and including the development of mechanical design, user interfaces design, programming, and control algorithms. (entrusted by company)
- Designed and developed novel optimal criteria and functional criteria to improve the adaptivity, robustness, safety and efficiency of the redundant manipulator, and to fully utilize the flexibility of redundant manipulators.
- Developed a effective optimal control algorithm for the dual robot system to operate the complex work with the cooperation of machine vision. (entrusted by Hitachi)
- Published 9 SCI papers, obtained 6 authorized China invention patents, and obtained a grand prize of the 14th "Challenge Cup" competition in Guangdong.

Neurodynamics Strategies for Time-Varying Problems

Principal Leader, *Bionic Intelligent Robot (BIR) Lab*

Jan 2017 - Present

Advisor: Prof. Zhijun Zhang

- By introducing the integral of function error, designed the modify zeroing neural network strategy for solving time-varying matrix inverse problems with great tolerance to noise and finite-time convergent characteristic.
- Designed and proposed circadian rhythms neural network (CRNN) and discrete-time CRNN to press the periodic noise for time-varying optimal problems by inserting a compensation item into the recurrent neural network .
- Published 8 SCI papers, and obtained 3 authorized China invention patents.

Brain-Computer Interface based Robotic System

Principal Leader, *Key Technology and Application of BCI Lab (Key Laboratory)*

Jan 2016 - Dec 2018

Advisor: Prof. Zhijun Zhang

- Designed a mobile intention-driven intelligent robotic system consisted of a electric wheelchair, a redundant manipulator and a camera for the disable.
- Designed a efficient control strategy for the intelligent robotics system to help the disable to accomplish simple operation by electroencephalogram (EEG) with low mental workload.

- Published 1 paper, and obtained 1 China invention patent.

Six-Rotor Unmanned Aerial Vehicle

Principal Leader, *Bionic Intelligent Robot (BIR) Lab*

Jan 2017 - Present
Advisor: Prof. Zhijun Zhang

- Designed and developed a novel aerial vehicle system with six rotors through distributing sensors, programming control algorithms, and designing hardware circuits, mechanical structures and host software.
- Obtained 1 China invention patent.

HONORS AND AWARDS

- Professor Mao Zongyuan Scholarship, *Professor MAO Zongyuan Scholarship Fund* - December, 2021
- **Ph.D. National Scholarship**, *Ministry of Education of the People's Republic of China* - October, 2019
- **President Scholarship**, *South China University of Technology* - October, 2019
- Boeing Scholarship, *Boeing Airlines Club* - September, 2017
- The 14th "Challenge Cup" Special prize, *Guangdong Provincial Committee* - October, 2017
- The Chevron Technology Scholarship, *The Chevron Scholarship Foundation* - October, 2016

PUBLICATIONS

Siyuan Chen has published **13 SCI papers** and 1 EI paper, including many well-known journals in robots, neural network, and optimal control, such as, *IEEE-ASME Trans. Mechatron.*, *IEEE Trans. Ind. Inform.*, *IEEE Trans. Control Syst. Technol.*, *IEEE Trans. Ind. Inform.* and *IEEE Trans. Syst. Man Cybern. -Syst.* ([Google](#), Citation: 203; H-Index: 7; I10-Index: 6.)

Journal articles

- [J1] Z. Zhang (PI), **S. Chen**, *et. al.*, "A Circadian Rhythms Neural Network for Solving Redundant Robot Manipulators Tracking Problem Perturbed by Periodic Noise," *IEEE/ASME Transactions on Mechatronics*, 2021, 26(6): 3232-3242. (JCR:Q1, IF: 5.303) ([PDF](#), [Google](#))
- [J2] Z. Zhang (PI), **S. Chen**, *et. al.*, "Discrete-Time Circadian Rhythms Neural Network for Perturbed Redundant Robot Manipulators Tracking Problem With Periodic Noises," *IEEE Transactions on Industrial Informatics*, 2020, 18(1): 242-251. (JCR:Q1, IF: 10.215) ([PDF](#), [Google](#))
- [J3] Z. Zhang (PI), **S. Chen**, *et. al.*, "Taylor Discrete Circadian Rhythms Neural Network for Resolving Bi-Criteria Optimization Problem of Redundant Robot Manipulators Perturbed by Periodic Noises," *IEEE Transactions on Industrial Informatics*, 2021. (JCR:Q1, IF: 10.215) ([PDF](#), [Google](#))
- [J4] Z. Zhang (PI), **S. Chen**, *et. al.*, "Two Hybrid Multiobjective Motion Planning Schemes Synthesized by Recurrent Neural Networks for Wheeled Mobile Robot Manipulators," *IEEE Transactions on Systems, Man, And Cybernetics: Systems*, 2021, 51(5): 3270-3281. (JCR:Q1, IF: 13.451) ([PDF](#), [Google](#))
- [J5] Z. Zhang (PI), **S. Chen**, *et. al.*, "Compatible Convex-Nonconvex Constrained QP-Based Dual Neural Networks for Motion Planning of Redundant Robot Manipulators," *IEEE Transactions on Control Systems Technology*, 2019, 27(3): 1250-1258. (JCR: Q1, IF: 5.485) ([PDF](#), [Google](#))
- [J6] Z. Zhang (PI), **S. Chen**, *et. al.*, "Two Hybrid End-Effector Posture-Maintaining and Obstacle-Limits Avoidance Schemes for Redundant Robot Manipulators," *IEEE Transactions on Industrial Informatics*, 16(2): 754-763, 2019. (JCR:Q1, IF: 10.215) ([PDF](#), [Google](#))
- [J7] Y. Zhang, **S. Chen**, *et. al.*, "Adaptive projection neural network for kinematic control of redundant manipulators with unknown physical parameters," *IEEE Transactions on Industrial Electronics*, 2018, 65(6): 4909-4920. (JCR: Q1, IF: 8.236) ([PDF](#), [Google](#))
- [J8] Z. Zhang (PI), S. Yang, **S. Chen**, *et. al.*, "A Vector-Based Constrained Obstacle Avoidance Scheme for Wheeled Mobile Redundant Robot Manipulator," *IEEE Transactions on Cognitive and Developmental Systems*, 13(3): 465-474, 2021. (JCR: Q2, IF: 3.379) ([PDF](#), [Google](#))
- [J9] Z. Zhang (PI), Y. Huang, **C. Siyuan**, *et. al.*, "An Intention-Driven Semi-Autonomous Intelligent Robotic System for Drinking," *Frontiers in Neurobotics*, 11: 48, 2017. (JCR:Q2, IF: 2.650) ([PDF](#), [Google](#))
- [J10] Z. Tan, L. Xiao, **S. Chen**, *et. al.*, "Noise-Tolerant and Finite-Time Convergent ZNN Models for Dynamic Matrix Moore-Penrose Inversion," *IEEE Transactions on Industrial Informatics*, 16(3): 1591-1601, 2019. (JCR:Q1, IF: 10.215) ([PDF](#), [Google](#))
- [J11] Z. Jia, **S. Chen**, *et. al.*, "Velocity-Level Tri-Criteria Optimization Scheme for Different Complex Path Tracking of Redundant Manipulators," *IEEE Access*, 7: 64289-64296, 2019.(JCR:Q1, IF:3.367) ([PDF](#), [Google](#))
- [J12] Z. Jia, **S. Chen**, *et. al.*, "Tri-Criteria Optimization Motion Planning at Acceleration-Level of Dual Redundant Manipulators," *Robotica*, 38(6): 983-999, 2020. (JCR: Q1, IF: 2.088) ([PDF](#), [Google](#))
- [J13] Z. Jia, X. Qu, **C. Siyuan**, *et. al.*, "Acceleration-Level Multi-Criteria Optimization for Remedying Joint-Angle Drift of Redundant Manipulators on Complex Path Tracking," *IEEE Access*, 7: 95716-95724, 2019. (JCR:Q1, IF: 3.367) ([PDF](#), [Google](#))

Conference

- [C1] Z. Zhang, **S. Chen**, *et. al.*, “Matlab Simulink of Varying-Parameter Convergent-Differential Neural-Network for Solving Online Time-Varying Matrix Inverse,” *2016 9th International Symposium on Computational Intelligence and Design (ISCID)*, 2016, 1: 320-325. ([PDF](#), [Google](#))

PATENTS

Siyuan Chen has obtained **5 China authorized patents**, 1 China authorized utility model patent and 1 software registration copyrights.

Authorized Patent

- [AuP1] Z. Zhang (PI) and **S. Chen**, “A Primal-dual Neural Network Method for Robot Motion Planning with Nonlinear Constraints (一种非线性约束的原对偶神经网络机器人动作规划方法) ,” **Invention Patent**, Authorization Number: CN108015766B. ([Web](#))
- [AuP2] Z. Zhang (PI) and **S. Chen**, “An Extended Solution Set Dual Neural Network for Robot Motion Planning (一种机器人运动规划的拓展解集对偶神经网络解决方法) ,” **Invention Patent**, Authorization Number: CN108015765B. ([Web](#))
- [AuP3] Z. Zhang (PI), M. He and **S. Chen**, “A Runge-Kutta Type Periodic Rhythm Neural Network for Resistance to Periodic Noise (一种能抵抗周期噪声的龙格库塔型周期节律神经网络方法) ,” **Invention Patent**, Authorization Number: CN110000780B. ([Web](#))
- [AuP4] Z. Zhang (PI), J. Liang and **S. Chen**, “A Repetitive Motion Planning Method for Redundant Manipulators with Periodic Noise Suppression (一种抑制周期噪声的冗余度机械臂重复运动规划方法) ,” **Invention Patent**, Authorization Number: CN109129486B. ([Web](#))
- [AuP5] Z. Zhang (PI), J. Liang and **S. Chen**, “A Repetitive Motion Planning Method for Redundant Manipulator Based on Taylor-type Discrete Periodic Rhythm Neural Network Under Periodic Noise (在周期噪声下基于泰勒型离散周期节律神经网络的冗余度机械臂重复运动规划方法) ,” **Invention Patent**, Authorization Number: CN109129487B. ([Web](#))
- [AuP6] Z. Zhang (PI), L. Zheng and **S. Chen**, “A Robotic Fly (一种飞行机器人) ,” **Utility Model Patent**, Authorization Number: CN205891228U. ([Web](#))

Applied Patent

- [ApP1] Z. Zhang (PI), J. Liang and **S. Chen**, “A Repetitive Motion Planning Method for Redundant Manipulator Based on Euler Discrete Periodic Rhythm Neural Network (一种基于欧拉型离散周期节律神经网络的冗余度机械臂重复运动规划方法) ,” **Invention Patent**, Application Number: CN109086557A. ([Web](#))
- [ApP2] Z. Zhang (PI), J. Lin and **S. Chen**, “A Soft Interval Support Vector Machine Classification Method Based on Neural Dynamics (一种基于神经动力学的软间隔支持向量机分类方法) ,” **Invention Patent**, Application Number: CN109508735A. ([Web](#))
- [ApP3] Z. (PI), M. He and **S. Chen**, “A Moving Obstacle Avoidance Method for Redundant Manipulator based on Quadratic Programming (一种基于二次规划的冗余度机械臂移动障碍物躲避方法) ,” **Invention Patent**, Application Number: CN113276121A. ([Web](#))

SKILLS SUMMARY

- **Languages & Develot Tools:** Matlab & Simulink, Python, C++, Keil, Laview, VB, ROS, Solidworks, ARM, Windows, Gfig, Photoshop

Last updated: January 22, 2022