Jianing Zhao

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EDUCATION

Shanghai Jiao Tong University   **Sept. 2019 – Present**
Ph.D. in Control Science and Engineering, Supervised by: Xiang Yin   *Shanghai, China*

University of Science and Technology of China   **Sept. 2015 – June 2019**
B.Eng. in Automation   *Hefei, China*

RESEARCH INTERESTS

- System Control, Formal Methods, Discrete-Event Systems, Cyber-Physical Systems

My research centers around: i) Formal verification and synthesis of cyber-physical systems; ii) Game-Theoretical decision-making in dynamic environments; iii) Distributed control of multi-agent systems

Publications

Papers

1. **J. Zhao**, S. Li and X. Yin. A Unified Framework for Verification of Observational Properties for Partially-Observed Discrete-Event Systems. ***IEEE Transactions on Automatic Control***, accepted and in press, 2024. [PDF]

2. **J. Zhao**, K. Zhu, S. Li and X. Yin. To Explore or Not to Explore: Regret-Based LTL Planning in Partially-Known Environments. in ***22nd IFAC World Congress***, Yokohama, Japan, 2023. [PDF]

3. **J. Zhao**, S. Wang and X. Yin. Failure-aware Self-Diagnostic Task Planning under Temporal Logic Specifications. in ***22nd IFAC World Congress***, Yokohama, Japan, 2023. [PDF]

4. **J. Zhao**, K. Zhu, H. Hu, X. Yu, X. Li and H. Wang. Formation Control of Networked Mobile Robots with Unknown Reference Orientation. ***IEEE/ASME Transactions on Mechatronics***, published, 2023. [PDF]

5. **J. Zhao**, X. Li and X. Yu and H. Wang. Finite-Time Cooperative Control for Bearing-Defined Leader-Following Formation of Multiple Double-Integrators. ***IEEE Transactions on Cybernetics***, published, 2022. [PDF]

6. **J. Zhao**, X. Yu, X. Li and H. Wang. Bearing-Only Formation Tracking Control of Multi-Agent Systems with Local Reference Frames and Constant-Velocity Leaders. ***IEEE Control Systems Letters***, published, 2021. [PDF]

7. **J. Zhao**, H. Hu, K. Zhu, X. Yu and H. Wang. Distributed Rendezvous Control of Networked Uncertain Robotic Systems with Bearing Measurements. in ***IEEE International Conference on Robotics and Automation***, Xi'an, China, 2021. [PDF]

Preprints

1. To Explore or Not to Explore: Regret-Based LTL Planning in Partially-Known Environments (journal version) [PDF]

2. Sleep When Everything Looks Fine: Self-Triggered Monitoring for Signal Temporal Logic Tasks [PDF]

Ongoing Works

1. Motion Planning of Dynamical Systems using Hyperproperties for Signal Temporal Logics

2. Semantic-Dependence-Aided Exploration in Initially Unknown Environments under Temporal Logic Specifications

RESEARCH EXPERIENCE

Key Laboratory of System Control and Information Processing at SJTU   **Sept. 2019 - Present**

- **Topic 1:** A unified framework for verification of observational properties of DES

  - Unifies all properties in terms of HyperLTL, including diagnosability, predictability, detectability and opacity;

  - Construct a Kripke structure to capture the issue of the unobservability and the finite string semantics in partially-observable DES so that HyperLTL model checking techniques can be applied;

  - Provides a complexity hierarchy for different properties in terms of the alternation depth of the HyperLTL.

- **Topic 2:** Regret-based LTL planning in partially-known environments
  - Develop a knowledge-based game to capture the issues of exploration in partially-known environments;
  - Propose to use *regret* as a new metric to capture the trade-off between the actual cost spent and the potential benefit the robot may obtain for exploring unknown regions;
  - Exhibits better performance in exploring the environments than the worst-case-based planning.

- **Topic 3:** Bearing-only formation control of multi-agent systems
  - Consider formation control of multi-agent systems modeled by double-integrators with local reference frames;
  - Propose a fully distributed controller for the followers that depends merely on the measurement of relative bearings and relative orientations obtained in local reference frames;
  - Develop a technical lemma, based on the stability of perturbed systems, to guarantee the semi-global asymptotic stability of the controlled multi-agent systems.

- **Topic 4:** Formation control of mobile robots without relative orientations
  - Consider formation tracking control of multi-agent systems modeled by nonholonomic unicycles;
  - Design two kinds of observer-based control laws for followers without measurement of the leader's orientation;
  - Conducting validation experiments on the networked TurtleBot3 Burger mobile robots.

HONORS

Joyce M. Kuok Scholarship for Ph.D. Students	2023, SJTU
Weichai Power Scholarship for Ph.D. Students	2021, SJTU
Chinese Aerospace Science and Technology Scholarship	2020, SJTU
Outstanding Undergraduates	2018, USTC

RELEVENT COURSEWORK

Control Theory: Linear System Theory, Automatic Control Theory, Stochastic Methods in System and Control
Computer Science: Formal Methods for Dynamic Systems, Data Structure, TCP/IP, Game Theory
Mathematics: Probaility and Statistics, Optimization Method, Calculus, Matrix Theory, Linear Algebra

SERVICES

Reviewer: IEEE Transactions on Automation Science and Engineering, IEEE Transactions on Cybernetics, IEEE Control Systems Letters, Transactions of the Institute of Measurement and Control, IFAC World Congress, American Control Conference, IEEE Conference on Decision and Control, IEEE Conference on Automation Science and Engineering
Teaching Assistant: Stochastic Methods in Systems and Control (AU7022H, SJTU, Fall 2022/2023), Engineering Economics (MEM6003, SJTU, Fall 2021/2022/2023)
Conference Service: Co-chair for session "Multiple and Distributed Systems VI" of ICRA 2021

INVITED TALKS

To explore or not to explore: regret-based LTL planning in partially-known environments	IFAC WC, 2023
Failure-aware self-diagnostic task planning under temporal logic specifications	IFAC WC, 2023
Distributed rendezvous control of networked uncertain robotic systems with bearing measurements	ICRA, 2021
Bearing-only formation control of MASs with local reference frames and constant-velocity leaders	CDC, 2020

SKILLS

Languages: Chinese (native), English (fluent)
Programming: Python, C/C++, Java, MATLAB
Software: ROS, HyperLTL Model Checking, DES (JTUDES, M-DES)
Hobbies: Tennis, Table Tennis, Swimming, Film Review