Zongyao Jin

ROBOTICIST · PH.D.

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Experience

Beijing Science & Technology Project Manager Management Co. Ltd., *Beijing, China* *2025 - Present*

PHOENIX PROJECT MANAGER

- Supporting the establishment and development of key research institutions such as national labs and new R&D entities, as well as key regions such as the Three Cities and One District, etc.
- Phoenix Project was initiated by Beijing Municipality Government, administered by Beijing Municipal Science & Technology Commission, with Beijing Science & Technology Project Manager Management Co. Ltd. serving as its implementing platform.
- Government announcement: https://www.beijing.gov.cn/zhengce/zwmc/202201/t20220124_2598556.html

ByteDance, Seed Department, *Beijing, China* *2024 - 2025*

STAFF ROBOTICS SCIENTIST

- Developed and maintained reactive whole-body control, optimal control, model predictive control, impedance/admittance control, trajectory generation, and software infrastructure for humanoids with VLA and tele-operation, etc.
- Received 2 excellent team performance awards as a member of different teams.

Flexiv Robotics, *Santa Clara, CA, US* *2020 - 2024*

SENIOR ROBOTICS CONTROLS ENGINEER, 2022 - 2024
ROBOTICS CONTROLS ENGINEER, 2020 - 2022

- Developed whole body controllers, impedance, motion-force, visual-servo control tasks for flexible joint robots with redundant DOF.
- Developed robotic software architecture for various robots to perform manipulation tasks in unstructured environments.
- Acquired 1 patent, implemented and delivered 5 robotic software/algorithm products, received Beyond Expectations in annual performance review for 2 consecutive years.

Texas A&M University, *College Station, TX, US* *2015 - 2020*

PH.D. STUDENT

- Ph.D. research funded by NSF grant 1527828; proposed task learning, intent prediction, and blended shared control methods that allow robots to learn from demonstration and collaborate with humans.
- Published 9 peer-reviewed academic papers as the first author, 2 in IEEE Transactions on Control Systems Technology; Ph.D. thesis included as an independent chapter in the book of Recent Advances in Industrial Robotics; received 2 highest-level student awards from the graduate program.

China Academy of Space Technology, *Beijing, China* *2012 - 2015*

AEROSPACE SYSTEM ENGINEER

- Participated in the research and development of various space robotic systems.
- Published 2 peer-reviewed academic papers, acquired 3 patents.

Education

Texas A&M University, *College Station, TX, US* *2015 - 2020*

PH.D. IN MECHANICAL ENGINEERING

- Thesis: Novel Methods for Human-Robot Shared Control in Collaborative Robotics.

China Academy of Space Technology, *Beijing, China* *2009 - 2012*

M.S. IN AEROSPACE ENGINEERING

- Thesis: Dynamics and Path Planning for Large Redundant Space Manipulators with Link Flexibility.

Harbin Engineering University, *Harbin, Heilongjiang, China* *2005 - 2009*

B.S. IN MECHANICAL ENGINEERING

Skills

Analytical	Embodied AI Robotics, WBC, Impedance-Admittance Control, Visual-Servo Control, Trajectory Generation, Optimal Control, State Estimation, Software Architecture/Deployment, Full-Stack Web Development
Languages	C++, Python, Bash, CMake, vcpkg, Poetry, UV, HTML, CSS, JavaScript, SQL, npm, Vite, Jekyll, Liquid, React, FastAPI
Frameworks	ROS-2, Eigen, qpOASES, RBDL, RBDyn, Bullet, Gazebo, Chai3d, Three.js, Chart.js, gRPC, FastDDS, Zenoh, glog, spdlog, Qt

Honors

2025 **National High-Level Young Talent**, National Ministries and Commissions, China

2024 **ByteDance Semi-Annual Team Excellence**, ByteDance, China

2024 **ByteDance Quarterly Team Excellence**, ByteDance, China

2022 **Flexiv Robotics Annual Performance Excellence**, Flexiv Robotics, USA

2021 **Flexiv Robotics Annual Performance Excellence**, Flexiv Robotics, USA

2018 **Jame J. Cain Outstanding Graduate Student Achievement** *(0.2% award rate)*, Texas A&M University, USA

2017 **Jame J. Cain Graduate Teaching Excellence** *(0.2% award rate)*, Texas A&M University, USA

2009 **Provincial Outstanding Undergraduate Student** *(0.2% award rate)*, Heilongjiang Province Ministry of Education, China

2008 **National Undergraduate Scholarship** *(0.2% award rate)*, National Ministry of Education, China

Projects

Hybrid Motion-Force-Impedance Control for Generic Peg-In-Hole Manipulations

@ Flexiv Robotics

- Developed manipulation strategies for robots to reliably perform 0.1mm tolerance peg-in-hole under small uncertainties.
- Developed high performance operational space motion-force control algorithms that handle (1) dynamics model uncertainties, (2) robot singularity avoidance, (3) flexible joint dynamics, (4) impedance adjustment, (5) in-task nullspace decoupling projection.
- Developed online-generated self-adjusting trajectories that ensure 100% area coverage when performing peg-in-hole search.
- The developed package became one of Flexiv's highlighted technologies and is being used in all assembly applications.
- Demo: https://www.zongyaojin.com/tech/demo/2023/10/21/peg-in-hole.html

Image-Based Visual Servo Control for High Precision Flexible Printed Circuit Assembly

@ Flexiv Robotics

- Developed manipulation strategies for robots to reliably perform 0.01mm tolerance assembly under large uncertainties.
- Developed high performance image-based visual servo control algorithms that integrate (1) image Jacobian singularity avoidance, (2) feature depth estimation, (3) optimal feature sets alignment, (4) image space boundary protection, (5) Cartesian impedance blending.
- Developed a complete vision-based robot assembly solution by coordinating a team of AI and mechanical engineers to improve image detection quality and gripper design around the vision control algorithm limitations.
- The developed package became one of Flexiv's highlighted technologies and is being used in all FPC assembly applications.
- Demo: https://www.zongyaojin.com/tech/demo/2023/10/08/ibvs-control.html

Control Software Framework Redesign for Heterogeneous Robots and Motor Control Modes

@ Flexiv Robotics

- Restructured the company's control software framework to support whole body control of (1) parallel-link robots, (2) serial-link robots, (3) robots with linear rails or mobile platforms, (4) macro-mini robots, (5) dual-arm robots, (6) robot with mixed position and torque controlled joints, from 3-DOF to 15-DOF.
- Redesigned the company's (1) robot description data structure to handle robots with modular joint groups via URDF and SRDF, and (2) robot behavior system to allow users to dynamically switch task priorities and coordinate different joint groups.
- Refactored the company's control software architecture, optimized composition, inheritance, interface, factory structures to manage multiple dynamics, whole body controllers, control tasks, and robot behavior primitives with unified interfaces and minimal dependencies.
- Migrated the company's all existing controller modules to work with the new framework, maximized software extendibility.
- Demo: https://www.zongyaojin.com/tech/demo/2023/08/07/control-framework.html

Physics-Based Simulator in C++ for Robotics Research and Development *@ Flexiv Robotics*

- Designed and implemented a robot simulator in C++ with GUI, 3D graphics, data plots, dynamics, contact and collision physics.
- Designed the simulator's software architecture using various design patterns such that the dynamics, controllers, physics, graphics are polymorphic, decoupled, and scalable.
- Implemented whole body control, image-based visual servo control, position-based visual servo control, operational space motion-force control, impedance-admittance control, and online trajectory generators for Rn and SE(3).
- Verified various robot motion and control algorithms in the simulator before they are deployed to real Flexiv robots.
- Demo: https://www.zongyaojin.com/tech/demo/2023/05/21/robot-simulator.html

Robot Behavior Generation Software Toolbox for Semi-Repetitive Manipulations *@ Flexiv Robotics*

- Analyzed common patterns of semi-repetitive tasks and extracted the key components for building a generic software toolbox.
- Designed a software toolbox for clients to program semi-repetitive robot behaviors, implemented the robot behavior generation logic.
- Led the toolbox development with a team consists of UX designers, UI, software, and control engineers.
- The developed toolbox became one of Flexiv's "in-app purchase" software modules and is being used in all palletization-like applications.
- Demo: https://www.zongyaojin.com/tech/demo/2023/07/16/palletizing.html

Novel Methods for Human-Robot Shared Control in Collaborative Robotics *@ Texas A&M University*

- Proposed a set of theories to make construction robots more intelligent and collaborative; analogous to semi-autonomous driving, but construction machines work in more complicated environment and are more difficult to operate, these methods can help human operators control these machines without significant skills and training, and provide online intelligent assistance.
- Proposed and implemented methods for task learning from demonstration, operator intent prediction, control autonomy sharing and arbitration, online task model adjustments.
- Demo: https://www.zongyaojin.com/tech/demo/2020/08/01/phd-research.html

Personal Website with Jekyll, Python, Ruby, Liquid, HTML, CSS, Javascript *@ Extracurricular*

- Designed and implemented a personal website to organize study notes and fragments of life, and enjoy coding something just for fun.
- Incorporated Agile Project Management and documentation features inspired by Jira, Confluence, Feishu Doc, blog websites, and academic papers.
- Based on the concept of Model-View-Controller, developed data, templates, control logic modules that are decoupled and scalable.
- Demo: https://www.zongyaojin.com

Publications

[1] **Z. Jin**, P. Pagilla, "Shared Control with Efficient Subgoal Identification and Adjustment for Human-Robot Collaborative Tasks", in *IEEE Transactions on Control Systems Technology*, 2022.

[2] **Z. Jin**, P. Pagilla, H. Maske, G, Chowdhary, "Task Learning, Intent Prediction, and Adaptive Blended Shared Control with Application to Excavators", in *IEEE Transactions on Control Systems Technology*, 2021.

[3] **Z. Jin**, P. Pagilla, "Blended Shared Control in Collaborative Robotics (book chapter)", in *Volume 2: Recent Advances in Industrial Robotics, Manufacturing in the Era of 4th Industrial Revolution*, 2021.

[4] **Z. Jin**, P. Pagilla, "Subgoal Learning via Operator Command Quantification for Human-Machine Shared Control Task Modeling", in *American Control Conference*, 2020.

[5] **Z. Jin**, P. Pagilla, "Collaborative Operation of Robotic Manipulators with Human Intent Prediction and Shared Control", in *IEEE International Conference on Human-Machine Systems*, 2020.

[6] **Z. Jin**, P. Pagilla, "Operator Intent Prediction with Subgoal Transition Probability Learning for Shared Control Applications", in *IEEE International Conference on Human-Machine Systems*, 2020.

[7] **Z. Jin**, P. Pagilla, "Human-Robot Teaming with Human Intent Prediction and Shared Control", in *Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications*, 2020.

[8] **Z. Jin**, P. Pagilla, H. Maske, G, Chowdhary, "Methods for Blended Shared Control of Hydraulic Excavators with Learning and Prediction", in *IEEE Conference on Decision and Control*, 2018.

[9] **Z. Jin**, P. Pagilla, H. Maske, G, Chowdhary, "Blended Shared Control with Subgoal Adjustment", in *IEEE International Conference on Systems, Man, and Cybernetics*, 2018.

[10] **Z. Jin**, C. Tan, "A Space Manipulator Path Planning Method with Synthesized Optimization", in *Spacecraft Engineering*, 2015.

[11] **Z. Jin**, Y. Liu, C. Tan, “Review and Analysis of the Asteroid Capture and Retrieval Mission”, in *Spacecraft Engineering*, 2014.

Patents

[1] **Z. Jin**, Y. Chen, “A Novel Gripper and Manipulation Strategies for Cable Assembly Operations”, Flexiv Robotics, CN 114952915 A, 2022.

[2] A. Zhu, **Z. Jin**, et al., “A Nuclear Powered Manned Mars Spacecraft System”, China Academy of Space Technology, CN 206394910 U, 2017.

[3] A. Zhu, **Z. Jin**, et al., “A Manned Mars Spacecraft Exterior Design”, China Academy of Space Technology, CN 3034279633 S, 2017.

[4] C. Wei, **Z. Jin**, et al., “A Small Spacecraft Docking System Design”, China Academy of Space Technology, CN 103625656 B, 2015.

Hobbies

Piano: Achieved the 8th Grade in Piano Performance at the Central Conservatory of Music of China.

Running: A regular runner, averaging approximately 100 kilometers per month.