Tianyi Xiang

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Education

- **Yale University** — Newhaven,America
  Master of Science (MS) in Mechanical Engineering — *Fall 2024 – May 2025*

- **Xi'an Jiaotong-Liverpool University (XJTLU); Rank 1/36** — Suzhou, China
  BEng Mechatronics and Robotic Systems; Major GPA: 4.0/4.0 — *Fall 2020 – Summer 2024*

  Core Modules: Dynamic Systems (91), Instrumentation and Control (93), Engineering Mathematics (98), Mechanical Engineering Design (90), Microprocessor Systems (95), Electronic Circuits and Systems (97), Fluid Mechanics (92), Engineering Structures (97), Introduction to Mechatronics (91), Digit circuit (97), Computer Skills (91), Machine Learning, Industrial Automation and Robot Control, Robotic Systems, Pattern Recognition, Mechatronic Systems Development

Publications

[1] **Tianyi Xiang[1], et al.**, "Development of a Simple and Novel Digital Twin Framework for Industrial Robots in Intelligent Robotics Manufacturing," 20^{th} *International Conference on Automation Science and Engineering (CASE 2024)(Accepted)* Pdf; Video

[2] **Tianyi Xiang[1], et al.**, "A Novel Approach to Grasping Control of Soft Robotic Grippers based on Digital Twin," 29^{th} *International Conference on Automation and Computing (ICAC 2024)(Accepted)* Pdf;

Research Experience

- **A Novel Approach to Grasping Control of Soft Robotic Grippers based on Digital Twin**
  Research Assistant, XJTLU, Pdf — *Sep.2023 - present*
  - Proposed a Digital Twin (DT) framework for real-time motion and pose control of pneumatic flexible gripper in Unity3D, while the result satisfy industrial application manipulation
  - Constructed the four-section piecewise constant curvature flexible gripper model kinematics and pure mathematical simulation in Unity3D, achieved maximum task space error 3.4%
  - Implemented specific mapping by OpenCV image processing calibration method with gemini-pro 3D depth camera

- **Trajectory Planning, intelligent control and rocker-bogie Coordination of Mars Rover**
  Independent Research , XJTLU, Video — *Sep.2023 - present*
  - Recreating the rover's rocker-bogie suspension dynamic modeling system with servo and DC motor
  - leveraging Radar, Depth Cameras, and Simultaneous Localization and Mapping (SLAM), incorporating deep Reinforcement Learning for obstacle detection and avoidance
  - Designing and optimizing the trajectory strategy based on the Genetic Algorithm(GA) and geometrical interactions

- **Development of a Simple and Novel Digital Twin Framework for Manufacturing Robots**
  Research Assistant, XJTLU, Advisor: Dr.Quan Zhang; Pdf; Video — *Jun.2023 - Apr.2024*
  - Enabled a Simple and Novel Digital Twin System based on C# and Robot Web Service (RWS) in Unity 3D and Web-based Platform, discarding the traditional 3rd party tools like ROS and costly device like PLC, but achieving efficient communication with 17ms Refreshing Rate.
  - Integrated the real-time path planning based on Levenberg-Marquard Inverse Kinematics Numerical Solution executed in MATLAB, achieving X-Y-Z Global Linear Motion Control and Multi-Joint Motion Control with Reachability 100%, and Accuracy 100%.
  - Created a User-friendly Web-based Platform by WEBGL with a Remote Surveillance Camera, and easy accessible Graphical User Interfaces (GUI) including functions like Pointer Operation, I/O System Operation in real-time control

- **The dynamic optimization of Automated Guided Vehicle (AGV)**
  2022 ABB Smart Innovation Competition: First prize; Intro — *Jun.2022 - Sep.2023*
  - Applied dynamic optimization of local trajectory planning through LQR, Dual-loop PID, stanely method, and MPC Motion control algorithms to AGV incorporating B-spline and A-star method, with simulation and modelling in Automation studio, MapleSim, and Scene Viewer

- Designed self-supervised spline interpolation techniques to generate control points, achieving a maximum deviation of lower 50%(in unit) in critical turning areas in rare 3% occurrence probability
- Innovatively utilized intelligent visual distance-refresh methodology to compensate the non-completely homogeneous trajectory points due to B-spline planning incorporating with dual-loop PID
- Obtained the sliding friction coefficient 0.2, by tire Magic Fomula to render the control algorithm designed applicable

- **Dynamic Optimization of ROS SLAM for Autonomous Vehicles**
  Independent research, XJTLU, video *Jun.2022 - Aug.2022*
  - Developed and implemented a SLAM-based navigation system for an autonomous vehicle with radar using ROS and Gazebo
  - Leveraged AMCL for adaptive localization and differential drive controllers, combining with Move_Base for efficient navigation in simulated environments.
  - Optimized traditional path planning methodologies (e.g., A* and RRT), achieving a 30% increase in localization accuracy and a 25% reduction in computational overhead, significantly enhancing both precision and efficiency.

- **Optimization Design and Simulation of Low Reynolds Numbers Turbojet Aircraft**
  Research Assistant, XJTLU, Advisor: Dr.Quan zhang ; Introduction *Apr.2022 - June.2022*
  - Optimised and modeled attack angle of 10.4° of AVERJANO type airfoil to obtain the minimum drag-lift ratio under low Reynolds number atmosphere ($Re = 50000$) through PROFILI numerical solution;
  - Designed and built mathematics model of the turbojet engine, and analyzed the accuracy of 63.7% compared with calculation through ANSYS Fluent workbench (finite element analysis) simulation, optimizing the fuel injection rate during taking-off period performance via numerical simulation;
  - Selected manufacturing materials for enhancing environmental adaptability; designed the assembly of actuators, materials, and power supply to deliver the specified mobility, power, robustness, and compactness.

Awards and Honors

2024	*Best Overall Academic Performance (Rank 1 Overall)*	*Xi'an Jiaotong-Liverpool University*
2023	*University Academic Excellence Award (Rank 1/36)*	*Xi'an Jiaotong-Liverpool University*
2023	*University Summer Undergraduate Research Fellow*	*Xi'an Jiaotong-Liverpool University*
2022	*ABB Smart Innovation Competition: First prize(Rank 3/275)*	*ABB, B&R Industrial Automation*
2022	*University Academic Excellence Award (Rank 1/64)*	*Xi'an Jiaotong-Liverpool University*
2022	*University Summer Undergraduate Research Fellow*	*Xi'an Jiaotong-Liverpool University*

Teaching Experience

- **Research Assistant**
  XJTLU, Suzhou, China *Fall 2023 – Spring 2024*
  - PID parameterization and tuning for the servo motors which drive for the Cartesian robot station and Tripodworkstation, respectively
  - Designed the coding and implementation platform in Automation Studio affiliated to B&R Co.
  - Applied servo motor control system and mastered the basic operation of its maintenance

Skills

- **Programming**: C/C++/C#, ARM assembly, MATLAB, RAPID, KRL, Python, ST
- **Tools**: Visual Studio, Blender, Unity 3D, SolidWorks, Fusion 360, PTC cero, CAD, Origin, MATLAB, SIMULINK, Carsim, LTspice, ANSYS Fluent, ROS, Dr. Frame, OfficeLite , RobotStudio, Automation studio
  , Malpsim, Scene viewer, Profili
- **Language**: Mandarin(Native), English(Fluent, IELTS 7.0)