Xinyang Tian

Email：tianers@buaa.edu.cn Google Scholar：[link] Github: [link] Contact：+8618810283175

EDUCATION

Beihang University, Beijing, China

Beijing
Sep 2016.9 ~ Present

Ph.D.   **Mechatronic Engineering**   **Supervisor：Qiang Zhan**

Thesis：Research on Key Technology of Modular Anthropomorphic Manipulator.

Northeast Agricultural University, Harbin, China

Harbin
Sep 2012.9 ~ 2016.6

B.S.   **Mechanical Engineering and Automation**   **Supervisor：Longzhe Quan**

Thesis：Dimensional Synthesis of Fruits and Vegetables Sorting Robot and Test Based on Delta Parallel Mechanism.

INTERESTS & SKILLS

- **Research Interests**: Robotic joint & manipulator design, impedance control, physical-human interaction.
- **Languages:** C++, Python, MATLAB.
- **General Tools**: SolidWorks, Fusion360, ANSYS, Altium Designer, Qt Creator, VS code.
- **Robot Simulation Tools**: ROS (melodic version), MATLAB/Simscape, Vrep.
- **Specialized Theory:** Robotics, Lie group, Passivity theory, Automatic control theory.

PUBLICATIONS & PATENTS

PUBLICATIONS:

[1] **Xinyang Tian**, Qiang Zhan. A Hermaphrodite Electromechanical Connector for Self-reconfigurable Robot Modules, *IEEE/ASME Transactions on Mechatronics*, vol. 26, no. 6, pp: 3276-3281, 2021. (**Q1, IF:5.867**)

[2] **Xinyang Tian**, Qinhuan Xu, and Qiang Zhan. An analytical inverse kinematics solution with joint limits avoidance of 7-DOF anthropomorphic manipulators without offset, *Journal of the Franklin Institute*, vol.358, no.2, pp.1252-1272, 2021. (**Q1, IF:4.246**)

[3] **Xinyang Tian**, Qiang Zhan. Design of ArmBot: A Self-Reconfigurable Robot Module with Electromechanical Connectors, In *Proc. 2019 4th International Conference on Robotics and Automation Engineering* (ICRAE), 2019, pp. 163-167.

[4] Qinhuan Xu, Qiang Zhan, and **Xinyang Tian**. Link Lengths Optimization Based on Multiple Performance Indexes of Anthropomorphic Manipulators, *IEEE Access*, vol. 9, pp. 20089-20099, 2021. (**Q2, IF:3.476**)

[5] **Xinyang Tian**, Qiang Zhan, and Yin Zhang. Simplified Configuration Design of an Anthropomorphic Hand Imitating Specific Human Hand Grasps. *IEEE Robotics and Automation Letters*. (Under review)

[6] **Xinyang Tian**, Qiang Zhan, and Ziyang Cheng. Ultra-Compact Joint Torque Sensor Units with Enhanced Resolution for Modular Manipulator. *IEEE Sensors*. (On line).

[7] Qiang Zhan, **Xinyang Tian**, and Qinhuan Xu, A Continuous Approach for Task Transition of Redundant robot Under Hard Joint Constraints, *IEEE Robotics and Automation Letters*. (Ready for submit).

PATENTS:

[1] Authorized invention patent CN201810281440.7, "Electromechanical connector for self-reconfigurable robot", Qiang Zhan, **Xinyang Tian**, Junqing Wang, and Chunhong Li.

[2] Authorized invention patent CN202110754392.0, "Admittance control method of dexterous hand based on extended state observer", Qiang Zhan, **Xinyang Tian**.

[3] Authorized invention patent CN201510186809.2, "Adaptive top-out fruit and vegetable gripper", Longzhe Quan, **Xinyang Tian**, Jiawu Zhang, et al.

PROJECTS

Ph. D project   Dec 2019 – Aug 2022

Source: Liberation Army Aviation Pre – Research Project

Main work:

- Responsible for the 7-DOF anthropomorphic manipulator design, including three different sizes robotic joint design, joint torque sensors design, and electromechanical coupling quick changer design;
- Proposed an analytical inverse kinematics solution with arm manifold control, free - singularity and joint limits avoidance for 7-DOF manipulator;
- Established the inverse dynamic model of 7-DOF anthropomorphic manipulator using Newton – Euler method, and the model was simulated by MATLAB/Simscape and open source dynamics library **Pinocchio**, respectively;
- The parameter identification method and compliance control strategy of flexible joints were studied, and a parameter identification software was developed based on Qt Creator. On this basis, the motor-torque coefficient identification, friction identification, stiffness and damping identification were carried out, and the position/torque control of the flexible joint was realized based on the full-state feedback control theory;
- Set up a dynamic torque calibration platform for joint torque sensors, and a calibration software of joint torque sensor was developed based on Qt Creator;
- The collision detection of manipulator based on generalized momentum observer was studied. On this basis, a collision detection method considering end disturbance was proposed and verified by MATLAB/SIMSCAPE;
- The joint space/Cartesian space impedance control method of the manipulator were studied. On this basis, the tracking control (position & orientation) of the 7-DOF anthropomorphic manipulator with Nullspace compliant was further studied and verified by MATLAB/Simscape;
- Developed a human-interaction software for the manipulator protype based on ROS + Qt Creator, and a series of experiments were carried out, such as forward/inverse kinematics, joint space/Cartesian space impedance control, Nullspace impedance control, and collision detection.

Dexterous hand design and compliant control   Oct 2017 – Jun 2021

Source: Beijing Nature Science Foundation

Main work:

- Responsible for the dexterous hand design, including structure design of finger & palm, scale and layout optimization;
- Proposed an admittance control method of dexterous hand based on extended state observer;
- Developed a hand prototype, and the dexterity of the prototype was verified by Cutkosky classification test.

Research on self-reconfiguration modular robot technology   Dec 2016 – May 2018

Source: Frontier Innovation of National Defense Science and Technology Special Zone Project

Main work:

- Responsible for the 3-DOF self-reconfigurable robot design, including modular joint design (structure), connector design (structure & hardware circuit);
- Proposed an electromechanical interface for power & communication transmission and orientation detection;
- Developed a human-interaction software 3-DOF self-reconfigurable robot based on Qt Creator, and a series of experiments of the prototype were carried out.

HONORS & CERTIFICATIONS

- Glodon Social Scholarship
- Beihang's Postgraduate outstanding academic innovation achievement award
- National Mathematics Competition for Postgraduate Students   **The Second Prize (2016)**
- "Challenge cup" National Competition   **The Third Prize (2015)**
- Mathematical Contest in Modeling Certificate of Achievement   **Honorable Mention (2015)**
- Mathematical Contest in Modeling Certificate of Achievement   **Honorable Mention (2014)**
- College English Test Band 6