LIN Qian

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Education

Tsinghua University, Beijing *Aug. 2016 – Jun. 2020*

- B.S.E. in Mechanical Engineering. Major GPA: 3.75/4.0; Rank: 4/104 (**Top** female student in the department)
- Minor in Computer Science. GPA: 3.72/4.0.
- Core Courses (Mechanical Engineering): Control Engineering (A), Mechanical Design, Mechanical Theory (A-), Manufacture, Robotic Technology and Application (A-), Computer Simulation for Mechanical System (A-), Engineering Thermodynamics (A), Fluid Mechanics, Strength of Material (A-), Engineering Material (A-), Theoretical Mechanics, Electronical and Electrical Engineering (A-), Mechanical Graphics (A), Introduction to Complex Analysis (A), Physics (A), Calculus (A), Linear Algebra (A)
- Core Courses (Computer Science): Artificial Intelligence (A-), Graph Theory (A-), Data Structure and Algorithm (A-), Fundamentals of Computer Aided Design, JAVA and Object-Oriented Programming, C++ Programming (A-), Computer Networks, Computer Organization and Architecture

Summer internship at RPK Laboratory, Johns Hopkins University *Aug. 2018 – Sept. 2018*

Summer internship at ModLab, GRASP Lab, University of Pennsylvania *Jun. 2019 – Sept. 2019*

Research Experience

Surface Adaptive Exploration of Mechanical Finger *Mar. 2020 – Jun. 2020*

Advisor: Prof. Yao Jiang, Assistant Professor at Tsinghua University

- Surface adaptive is the ability of human/robot hand slides along the surface of the object without leaving the surface and at the same time, controls the force applied on the surface of the object when in contact with an object. Human hands can tackle with complex and unknown surfaces but robots usually work with simple and known surfaces.
- Modeled robot finger with a 2-link system whose base would slide horizontally at a constant speed. Proposed the kinematic and mechanical model of a mechanical finger, as well as the contact model between finger and environment.
- Established a platform on ROS to simulate the surface sliding process of the mechanical finger. Applied PID controller and compliance controller respectively for contact tooling and surface exploring tasks.

Parallel Self-Assembly with SMORES-EP, a Modular Robot *Jun. 2019 – Sept. 2019*

Advisor: Prof. Mark Yim, Professor at University of Pennsylvania

- Proposed an efficient framework to assemble SMORES (Self-Assembling MOdular Robot for Extreme Shapeshifting), a modular robot model, as tree configurations in parallel. Developed two controllers to guarantee the success of docking modules.
- Designed a special SMORES module with payload and relevant strategies to help other modules to connect with side faces, which would be infeasible for the modules to complete alone. Wrote a simulator in rviz, the visualization tool in Robot Operating System (ROS), for CKbot (Connector Kinetic roBot), another modular robot model. Developed a speed controller for the rotation DoF of SMORES.
- Proposed a parallel modular robot self-assembly algorithm that can improve the capability of modular robots to interact with the environment. Demonstrated on real hardware, which is quite hard to implement.

Exploring Characteristics of Human Interactive Grasping Platform *Apr. 2019 – Sept. 2019*

Advisor: Prof. Tiemin Li, Professor at Tsinghua University

- Designed a platform to explore human grasping mechanism with both visual and haptic sensors to create more reliable sensors and grasping strategies.
- Proposed a criterion to evaluate the accuracy of the platform. Developed an algorithm to detect the slip state of fingers with visual sensor.
- Developed a platform which consists of semiconductor strain gauge, miniature camera and laser displacement sensor, and can measure the slip state of human grasping accurately and sensitively.

Collision Detection via Closed-Form Minkowski Sum *Aug. 2018 – Sept. 2018*

Advisor: Prof. Gregory S. Chirikjian, Professor at Johns Hopkins University

- Completed a demonstration of *Rapidly-exploring Random Tree Algorithm* in ROS.
- Adopted quartic solver to *Algebraic Separation Conditions Algorithm* to improve speed (~ 20x faster than previous test) to compare with proposed collision detection algorithm between ellipsoidal and superquadric agents based on closed-form *Minkowski Sum*.
- Proposed a collision detection algorithm efficient in both time and space, which runs ~2x faster than Gilbert-Johnson-Keerthi algorithm in the cases involving superellipse and superquadric.

Mechanical LIDAR Based on Trigonometry Distance Measurement *Jan. 2018 – Jun. 2018*

Research Assistant | *Advisor: Prof. Jun Zhu, Associate Professor at Tsinghua University*

- Built a small opto-mechatronics system sending laser beam for range to perceive obstacles in the surrounding environment.
- Introduced dual receivers to reduce blind zone. Applied wireless power supply, wireless communication scheme and motor directly driving scheme. Developed PC software with Python to visualize range information.
- Developed a system including optical, mechanical, circuit and communication systems. Achieved high precision ranging and reconstruction under low costs.

Dynamic Modeling of the Harmonic Drive System *Sept. 2017 – May 2018*

Research Assistant | *Advisor: Prof. Shaoze Yan, Professor at Tsinghua University*

- Proposed a new dynamic model of the Harmonic Drive System, which can reveal the Stick-Slip phenomenon. Considered other nonlinear factors in the system comprehensively to improve the dynamic model.
- Proposed a precise model that can guide the further precise control to achieve better performance of Harmonic Drive.

Finite Element Analysis of the Real Contact Area of Rough Surface *Mar. 2017 – Dec. 2017*

Research Assistant | *Advisor: Prof. Shaoze Yan, Professor at Tsinghua University*

- Conducted finite element analysis on real contact area and contact characteristic of rough micro-surface models in uploading contact process.
- Discovered that real contact area and normal load shows linear relationship under regular load, which agrees with the previous experiment. Concluded from the curve of real contact area and load that the self-affine fractal surface model better describes the contact characteristic of real rough surface than the Gaussian surface model.

Working Experience

Internship of L-4 Driverless Vehicle *Jul. 2020 – Jan. 2021*

- Maintained the simulation platform in the decision planning group.
- Developed a map display plugin in Rviz. Reconstructed lattice planning module.
- Improved the simulator with log-sim (run the developed cars together with real car trajectories in the log file), automatic graders, and behavior assignable virtual vehicles.

Publication

C. Liu, **Q. Lin**, H. Kim, M. Yim. "Parallel Self-Assembly with SMORES-EP, a Modular Robot," Autonomous Robots, accepted.

S. Ruan, K. L. Poblete, Y. Li, **Q. Lin**, Q. Ma and G. S. Chirikjian, "Efficient Exact Collision Detection between Ellipsoids and Superquadrics via Closed-form Minkowski Sums," *2019 International Conference on Robotics and Automation (ICRA)*, Montreal, QC, Canada, 2019, pp. 1765-1771.

Awards and Membership

Outstanding graduate student of Beijing **(6/127)** *Jun. 2020*

Sandvik Coromant Scholarship for comprehensive excellence (**2/127**) *Oct. 2019*

Member of Spark Innovative Talent Cultivation Program (**50/3500**, Tsinghua) *Dec. 2018*

Nanxiang Jiang Scholarship (**top 1%** junior students, award for comprehensive excellence) *Oct. 2018*

Honorable Mention of the Interdisciplinary Contest in Modeling *May 2018*

Friends of Tsinghua – PetroChina Scholarship (**1/140**, award for comprehensive excellence) *Oct. 2017*

EXTRA-CIRRUCULAR

Leader and maintainer of student website (http://mechinfo.me) *Mar. 2017 – Jan. 2019*

Regular member of SkyWorks (the largest student science and technology association in Tsinghua) *Jun. 2018*

Volunteer of Instructing Service for Basic Courses *Oct. 2016 – Jun. 2018*

Skills

· **Program language**: C++, Java, Python, MATLAB.
· **Library**: OpenGL, OpenCV.
· **System**: MSP430, STM32, Arduino, ROS.
· **Software**: ANSYS, AutoCAD, SolidWorks.
· **Language**: Mandarin (Native), Wu (Native), English (Fluent).