

Guanglu Jia

College of Design and Engineering, Department of Mechanical Engineering,
National University of Singapore, Singapore

Gender: Male

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Research Interests

Robot design, Lie algebra and Lie group, metamorphic mechanisms and robotics, screw theory, grasping robotic hand design, type synthesis method, origami-inspired mechanisms, theoretical kinematics

Education

- 09/2016-12/2021 **Ph.D.**, Mechanical Engineering, **Harbin Institute of Technology, Shenzhen, China**
Supervisors: **Prof. Dan Zhang (Fellow of the Canadian Academy of Engineering)**
Thesis: Study on type synthesis of spatial truss mechanisms with folding and grasping configurations
- 09/2014-06/2016 **M.Eng.**, Mechanical Engineering, **Harbin Institute of Technology, Shenzhen, China**
Supervisor: **Prof. Bing Li**
Major: Academic English writing, Optimization Methods, Principle and Application of Embedded System, Robot Technology, Advanced Dynamics, Numerical Analysis, Autonomous Robot Navigation, Theoretical Kinematics and Advanced Mechanisms.
Overall GPA: 3.33/4.0
Thesis: Study on influence of surface defects in silicon-based materials on polishing quality in atmospheric plasma
- 09/2009-06/2013 **B.Eng.**, Mechanical Design and Manufacture and Automation, **Changsha University of Science and Technology, China**
Major: Mechanical Drawing, Mechanical Principle, Mechanical Design, Mechanical Technology, Error Theory and Data Processing, Geometric Precision Measuring Instrument Technology, Interchangeability and Technical Measurement, C Language.
Overall GPA of 3.44/4.0, GPA on Specialized Basic Courses of 3.72/4.0.

Research Experience

- 06/2023-present
Research Fellow, **National University of Singapore.**
 - A novel climbing robot concept was proposed;
 - A Smart Corner Casting Lock was designed.
- 01/2022-03/2023
Research Associate, **King's College London, London.** EPSRC Engineering and Physical Sciences Research Council, UK (Grant No. RE14975), "Reconfigurable lower limb exoskeleton for effective stroke treatment in residential settings."
 - Adjoint transformation of the Lie bracket was proposed;
 - Klein form in adjoint action was demonstrated;
 - Intrinsic Relation between Klein Form and the Lie Bracket was revealed.
- 01/2017-12/2020
Ph.D., **Harbin Institute of Technology, Shenzhen.** Innovative Research Groups and the Joint Funds of

the National Natural Science Foundation of China (Grant No. U1613201), titled “Research on innovative design and on-orbit control method of large-scale intelligent structures.”

- A class of block-shaped ori-blocks was designed, which was kinematic equivalent to classic over-constrained linkages like Bennett linkage, Myard linkage, and Bricard linkage;
- The deployment/grasping motion of a sub-chain was analyzed using the decomposition theorem of the constraint screw system;
- A comprehensive type synthesis method based on reciprocal screw theory was proposed to construct reconfigurable mechanisms;
- A constraint force decomposition theorem was provided to create a family of deployable grasping parallel mechanisms;
- The performance evaluation indexes of mechanisms were analyzed, such as the deploy/fold ratio and stiffness/mass ratio.

4. 07/2015-12/2016

M.Eng, **Harbin Institute of Technology, Shenzhen**. Shenzhen Hong Kong Innovation Circle Joint Research and Development Project (Grant No. SGLH20131010144128266), titled “Ultra-precision machinery and plasma hybrid polishing technology and equipment for processing superhard materials”; and Development Project and National Natural Science Foundation of China (Grant No. 51305104).

- Several typical dislocation models were established to study the effect of crystal defects on atmospheric plasma polishing;
- The Materials Studio software was used for modeling and simulation, which was applied to investigate parameters such as the number of states, activation energy, reaction energy barrier, the density of states, etc;
- The X-ray diffractometer and white light interferometer were applied to conduct verification experiments.

Publications

Journal Papers Published

- [1] **Guanglu Jia**, Bing Li, Jian S. Dai. Metamorphic Oriblocks:Design and Kinematic Analysis of Metamorphic Oriblocks Constructed by Cutting and Linking Cylinders/Cones, *Journal of Mechanical Engineering* 59(13) (2023): 24-35.
- [2] Zhuo Chen, Qiu hao Chen, **Guanglu Jia**, Jian S. Dai. Sylvester’s dialytic elimination in analysis of a metamorphic mechanism derived from ladybird wings, *Mechanism and Machine Theory* 179 (2023): 105102. (SCI, IF=5.2, JCR Q1)
- [3] Sen Wang, Hailin Huang, **Guanglu Jia**, Bing Li, Hongwei Guo, Rongqiang Liu, Design of a novel three-limb deployable mechanism with mobility bifurcation, *Mechanism and Machine Theory* 172 (2022): 104789. (SCI, IF=5.2, JCR Q1)
- [4] **Guanglu Jia**, Hailin Huang, Sen Wang, Bing Li, Type synthesis of plane-symmetric deployable grasping parallel mechanisms using constraint force parallelogram law, *Mechanism and Machine Theory* 161(2021): 104330. (SCI, IF=5.2, JCR Q1)
- [5] **Guanglu Jia**, Hailin Huang, Hongwei Guo, Bing Li, Jian S. Dai, Design of Transformable Hinged Dissections of Cylinders and Cones, *ASME Journal of Mechanical Design* 143(9) (2021): 094501. (SCI, IF=3.3, JCR Q2)
- [6] **Guanglu Jia**, Bing Li, Hailin Huang, Dan Zhang, Type synthesis of metamorphic mechanisms based on different kinds of connecting pairs, *Mechanism and Machine Theory* 151 (2020): 103848. (SCI, IF=5.2, JCR Q1)

- [7] Changqing Gao, Hailin Huang, Bing Li, **Guanglu Jia**, Design of a truss-shaped deployable grasping mechanism using mobility bifurcation, *Mechanism and Machine Theory* 139 (2019): 346–358. (SCI, IF=5.2, JCR Q1)
- [8] **Guanglu Jia**, Hailin Huang, Bing Li, Yanlin Wu, Qidi Cao, Hongwei Guo, Synthesis of a novel type of metamorphic mechanism module for large scale deployable grasping manipulators, *Mechanism and Machine Theory* 128 (2018): 544–559. (SCI, IF=5.2, JCR Q1)
- [9] **Guanglu Jia**, Bing Li, Jufan Zhang. Influence of SiC surface defects on materials removal in atmospheric pressure plasma polishing, *Computational Materials Science* 146 (2018):26-35. (SCI, IF=3.3, JCR Q3)
- [10] Jiangbo Chen, **Guanglu Jia**, Bing Li, Jufan Zhang, Xichun Luo. Deterministic removal of atmospheric pressure plasma polishing based on the Lucy-Richardson algorithm, *Machining Science and Technology*, 22(6) (2018): 953-967. (SCI, IF=2.7, JCR Q3)

Journal Papers in Preparation

- [11] Jian S. Dai, Guanglu Jia, Shaoqiang Deng. Adjoint Transformation of the Lie Bracket and Adjoint Representation of the Klein Form and Their Intrinsic Relation in $se(3)$, *IEEE Transactions on Robotics*.
- [12] Guanglu Jia, Jian S. Dai. Novel design and analysis of reconfigurable metamaterial using oriblocks, *Proceedings of the National Academy of Sciences*.

International Conference Papers Published

- [13] Weida Cheng, Hailin Huang, Bing Li, **Guanglu Jia**, Fujun Peng, Aiguo Wu, Thermal-Mechanical Coupling Analysis and Structural Optimization of a Deployable Grasping Manipulator, *International Conference on Intelligent Robotics and Applications*, (2021): 451-462. (EI)
- [14] Yanlin Wu, Hailin Huang, Xiaojun Yang, Bing Li, Guanglu Jia, Qidi Cao, Design and analysis of a quadrangular truss-shaped deployable robotic manipulator for grasping large scale objects, *2018 IEEE International Conference on Cyborg and Bionic Systems*, (2018): 460-465. (EI)
- [15] **Guanglu Jia**, Hailin Huang, Yanlin Wu, Qidi Cao, Design and Analysis of an Underactuated Robotic Hands for Grasping Space Irregular-Shaped Non-Cooperative Objects, *2017 IEEE International Conference on Information and Automation*, July 18-20 (2017) Macau SAR, China. (EI)
- [16] **Guanglu Jia**, Bing Li, Hailin Huang, Yanlin Wu, Qidi Cao, Analysis of an Underactuated Biomimetic Octopus Hand for Grasping Space Non-Cooperative Objects, *2017 IEEE International Conference on Cyborg and Bionic Systems*, October 17-19 (2017) Beijing, China. (EI)
- [17] **Guanglu Jia**, Bing Li, Jufan Zhang. Study on Influence of Silicon Crystal Dislocation on Removal in Atmospheric Pressure Plasma Polishing, *Materials Science Forum*, 878 (2016): 83-88. (EI)

Patents

- [18] Bing Li, **Guanglu Jia**, Hailin Huang, Hongwei Guo, A truss-type deployable grasping metamorphic mechanism, China Patent: ZL 201810366062.2, May 14, 2021.
- [19] Bing Li, **Guanglu Jia**, Hailin Huang, Hongwei Guo, A rigid deployable grasping metamorphic mechanism, China Patent: ZL 201810366075.X, May 14, 2021.
- [20] Bing Li, **Guanglu Jia**, Hailin Huang, Hongwei Guo, Design of deployable grasping metamorphic mechanism based on constraint screw, China Patent: ZL 201810366964.6, Feb 02, 2021.

Academic Activities

1. Reviewer of the *International Journal of Robotics and Research*, *Mechanism and Machine Theory*, and *ROBOTICA*. Reviewed more than 40 journal papers and was elected as the top reviewer of the journal *Mechanism and Machine Theory* in 2021 and 2022.
2. Was invited as a Speaker in ASME Journal of Mechanical Design 4th Webinar: Robot Design, Dec 09,

2021. (Only three papers were selected.)

3. **Oral and poster presentations at international conferences**, such as *the 2017 IEEE International Conference on Information and Automation* (July 18-20, 2017) and *the 2017 IEEE International Conference on Information and Automation* (October 17-19, 2017).

Honors & Awards

1. 2018 **National Scholarship**, top 2 among 198 postgraduates in School of Mechatronic Engineering and Automation, Harbin Institute of Technology, Shenzhen.
2. 2016 **Outstanding Graduates**, top 3 among 30 postgraduates in School of Mechatronic Engineering and Automation, Harbin Institute of Technology, Shenzhen.
3. 2010-2013 Four times **first-class scholarship**, top 10 among 123 undergraduates in School of Mechanical Engineering, Changsha University of Science and Technology.
4. 2010, 2012 **National Inspirational Scholarship**, top 4 among 123 undergraduates Changsha University of Science and Technology.
5. 2011 **Third Prize in Hunan Province Physical Competition**, top 10 among 1000+ undergraduates in Changsha University of Science and Technology.

Skills

1. Modeling Software: SolidWorks, Creo
2. Manufacturing: AutoCAD
3. Mathematical & Statistical Package: Maple, MATLAB
4. Drawing and Image Processing Software: Adobe Illustrator, Adobe Photoshop
5. Simulation and Animation: Creo Illustrator, Adobe Premiere
6. Finite Element Analysis: Abaqus

Referees

1. Prof. Jian S Dai

Fellow of Royal Academy of Engineering (FREng), Membership of the Academia Europaea (MAE), IEEE Fellow, ASME Fellow, IMechE Fellow, PE, CEng, Editor-in-Chief of *ROBOTICA*, Chair Professor Dean of SUSTech Institute of Robotics, Shenzhen Key Laboratory for Intelligent Robotics and Flexible Manufacturing System, Southern University of Science and Technology, Shenzhen, 518055, China.

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2. Prof. Dan Zhang

Fellow of the Canadian Academy of Engineering, Fellow of the Engineering Institute of Canada, ASME Fellow, CSME Fellow, School of Mechanical Engineering, York University, Toronto, Canada.

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3. Prof. Chirikjian

IEEE Fellow, ASME Fellow, Senior Editor of the *International Journal of Robotics and Research*, joined the Department of Mechanical Engineering at the National University of Singapore in 2019 and was the Head of Department from 2019 to 2023.

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