Ke Wu

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Masdar City - Abu Dhabi - United Arab Emirates
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PARTICULARS

EDUCATION

National Institute for Research in Digital Science and Technology (INRIA)
École Centrale de Lille — Lille, France
Ph. D. in Robotics — *October 2019 - November 2023*

University College Dublin — Dublin, Ireland
M. S. in Mechanical Engineering — *June 2019*

Chongqing University — Chongqing, China
M. S. in Mechanical Engineering — *June 2019*

Chongqing University — Chongqing, China
B. E. in Mechanical Engineering — *April 2016*

RESEARCH INTERESTS

My research interests span the areas of design, modeling, optimization and control of robotic systems. I have a specific interest in deformable robotic systems, such as **soft robots**, **compliant mechanisms**, **continuum robots** and **rigid-compliant-coupled robotic systems**.

- **Robotics**
  - Kinematic, static and dynamic modeling of robotic systems.
  - Model-free and model-based control of robotic systems.
  - Model-based structure design and optimization of robotic systems.
- **Applied mathematics**
  - Modeling physical systems via algebraic and differential equations.
  - Model-free and model-based control of physical systems.
  - Model-based optimization problems.

DISSERTATION

Title: "Design, Modeling, Optimization and Control of Compliant Mechanisms"
Advisor: Gang Zheng
Jury members: Frederic BOYER, Jian S Dai, Li Zhang, Guillaume J. Laurent, Florence Bertails-Descoubes and Gang Zheng

My thesis develops a comprehensive framework for design, modeling, structure optimization and control of a typical type of deformable robotic systems, compliant mechanisms, which provides general guidelines for a wide variety of related mechanical systems. This thesis also paves the taste of my future research where I will keep focusing on the solid work behind all the studied robotic systems relying on mathematics: statics, kinematics, dynamics, sensing, estimation and so on.

PUBLICATIONS

JOURNAL PAPERS

1. Du F*...**Wu K**...A Sensor-Free Force Estimation Method for Notched Continuum Surgical Robot (accepted by *IEEE/ASME Transactions on Mechatronics*)

2. Chen R*...**Wu K**...Design, Modeling and Analysis of Large-stroke Compliant Constant Torque Mechanisms (accepted by *Mechanism and Machine Theory*)

3. Zhang X, ...**Wu K**...Du F* Design and Modeling of Continuum Robot for Endoscopic Submucosal Dissection Surgery with Lifting Force Estimation (accepted by *The International Journal of Medical Robotics and Computer Assisted Surgery*)

4. Wang W...**Wu K**, Bao G*, A Motion-Decoupled Pneumatic Rigid-Flexible Hybrid Joint With Variable Stiffness for Continuum Robots accepted by *Chinese Journal of Mechanical Engineering*)

5. Xu H...**Wu K**, Nguyen P, Kovac M, Wen L*, A Biomimetic Adhesive Disc for Robotic Adhesion-sliding Inspired by the 1 net-winged Midge Larva (accepted by *Soft Robotics*)

6. Zhang G, Du F*...**Wu K**... Continuum Robots: a Real-time Model-based Data-driven Nonlinear Controller (accepted by *IEEE Transactions on Industrial Electronics*)

7. Wang W...**Wu K***, Bao G*, A Modular Soft Pipe-climbing Robot with High Maneuverability (accepted by *IEEE/ASME Transactions on Mechatronics*)

8. Lv Z, **Wu K**, He Y*, Two-way FSI Simulation and Experiments for Finger-like Soft Pneumatic Actuator under High-speed Pressurization (accepted by *IEEE Robotics and Automation Letters*)

9. **Wu K**, Zheng G*, Chen G, Awtar S. A Body-frame Beam Constraint Model. *Mechanism and Machine Theory.* 2024 Feb 1;192:105517.

10. Zhou X, Wang H*, **Wu K**, Zheng G. Fixed-time Neural Network Trajectory Tracking Control for the Rigid-flexible Coupled Robotic Mechanisms with Large Beam-deflections. *Applied Mathematical Modelling.* 2023 Jun 1;118:665-91.

11. Zhou X, Wang H*, **Wu K**, Tian Y, Zheng G (2023). Nonlinear Disturbance Observer-based Robust Predefined Time Tracking and Vibration Suppression Control for the Rigid-flexible Coupled Robotic Mechanisms with Large Beam-deformations. *Computers & Mathematics with Applications*, 148, 1-25.

12. Chen R*, Wang W, **Wu K**, Zheng G, Xu X, Wang H, Luo J. Design and Optimization of a Novel Compliant Planar Parallelogram Mechanism Utilizing Initially Curved Beams. *Mechanism and Machine Theory.* 2023 Jan 1;179:105092.

13. **Wu K**, Zheng G*, Chen G. Extending Timoshenko Beam Theory for Large Deflections in Compliant Mechanisms. Journal of Mechanisms and Robotics. 2023 Dec 1;15(6):061012.

14. **Wu K**, Zheng G*. Solutions to Large Beam-deflection Problems by Taylor Series and Padé Approximant for Compliant Mechanisms. Mechanism and Machine Theory. 2022 Nov 1;177:105033.

15. **Wu K**, Zheng G*. Insight into Numerical Solutions of Static Large Deflection of General Planar Beams for Compliant Mechanisms. Mechanism and Machine Theory. 2022 Jun 1;172:104757.

16. **Wu K**, Zheng G*. Theoretical Analysis on Nonlinear Buckling, Post-buckling of Slender Beams and Bi-stable Mechanisms. Journal of Mechanisms and Robotics. 2022 Jun 1;14(3).

17. **Wu K**, Zheng G*. A Comprehensive Static Modeling Methodology via Beam Theory for Compliant Mechanisms. Mechanism and Machine Theory. 2022 Mar 1;169:104598.

18. **Wu K**, Zheng G*, Zhang J. FEM-based Trajectory Tracking Control of a Soft Trunk Robot. Robotics and Autonomous Systems. 2022 Apr 1;150:103961.

19. **Wu K**, Zheng G*. FEM-Based Nonlinear Controller for a Soft Trunk Robot. IEEE Robotics and Automation Letters. 2022 Mar 16;7(2):5735-40.

20. **Wu K**, Zheng G*, Hao G. Efficient Spatial Compliance Analysis of General Initially Curved Beams for Mechanism Synthesis and Optimization. Mechanism and Machine Theory. 2021 Aug 1;162:104343.

21. **Wu K**, Zheng G*. FEM-based Gain-scheduling Control of a Soft Trunk Robot. IEEE Robotics and Automation Letters. 2021 Feb 23;6(2):3081-8.

22. **Wu K**, Hao G*. Design and Nonlinear Modeling of a Novel Planar Compliant Parallelogram Mechanism with General Tensural-compresural Beams. Mechanism and Machine Theory. 2020 Oct 1;152:103950.

JOURNAL PAPERS UNDER REVIEW

23. Zhou X, Wang H*, **Wu K**... Event-triggered Robust Adaptive Fault-tolerant Tracking and Vibration Control for the Rigid-flexible Coupled Robotic Mechanisms with Large Beam-deformations (revisions under review in *IEEE Transactions on Systems, Man and Cybernetics: Systems*)

24. Chen R*, Zhou L, **Wu K**...Design and Modeling of Compliant Deployable Mechanisms via a Comprehensive Framework. (under review in *Mechanism and Machine Theory*)

25. Chen R*, Li X...**Wu K**...Designing Fully Compliant Bistable Mechanisms for Prescribed Kinetostatic Behaviors (under review in *ASME Transactions Journal of Mechanisms and Robotics*)

26. Chen R*...**Wu K**...Wu F, Framework Design of Planar Anti-buckling Compliant Rotational Mechanisms (under review in *Mechanism and Machine Theory*)

27. **Wu K**...Zheng G*, Kinetostatic Modeling of Compliant Mechanisms via Reduced-Mode Cosserat Rod Model (under review in *Mechanism and Machine Theory*)

28. **Wu K**...Zheng G*, Large-deflection Analysis of Pre-curved Slender Beams Defined in Different Coordinate Systems for Compliant Mechanisms (under review in *Mechanism and Machine Theory*)

29. Chen R*, Liu Y...**Wu K**...Design and Optimization of Compliant Constant-torque Mechanisms Utilizing Beams with Various Curvatures (under review in *Mechanism and Machine Theory*)

30. Ji X, **Wu K**, Xiong T*.The Progress of Soft Robotics in Cardiovascular Application. (under review in *Annual Review of Biomedical Engineering*)

31. Yang K*, Xu Z, **Wu K**...Design and Analysis of a Cable-driven Rigid-flexible Hybrid Robot with Variable Stiffness. (under review in *Mechanism and Machine Theory*)

32. Li X, Feng T,**Wu K**...Li T* Design and Modeling of a Multi-backbone Continuum Robot with a Large Extension Ratio. (under review in *International Journal of Mechanical Sciences*)

33. Xu X,**Wu K**...Chu Henry K.* Design and Kinetostatic Modeling of Spatial Flexure-based Tendon-driven Continuum Manipulator (under review in *IEEE/ASME Transactions on Mechatronics*)

34. Bai R...**Wu K**...Chen G*. Design of a Novel Compliant Constant-Torque Mechanism (under review in *Mechanism and Machine Theory*)

35. Mou L,...**Wu K**, Pu H*. An octagonal cylindrical origami structure with variable stiffness for soft robotics. (under review in *International Journal of Mechanical Sciences*)

36. ...

PROFESSIONAL ACTIVITIES

- Member of the Intelligent Robots Young Experts committee of Gesellschaft Chinesischer Informatiker in Deutschland e.V. from June 01, 2022 - .

SERVICE

- Reviewer (Journals) - *IEEE Transactions on Robotics, IEEE Robotics and Automation Letters, Soft Robotics, IEEE Transactions on Intelligent Transportation Systems, Nonlinear Dynamics, International Journal of Humanoid Robotics, ASME Journal of Mechanisms and Robotics, Ocean engineering*
- Reviewer (Conferences) - *RoboSoft, IROS, ICRA*

LANGUAGES

Native Chinese speaker, proficient in English.

REFERENCES

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