

Research topics for graduate students for 2024

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Acceptable course(s)

- Master's Degree
- Doctoral Degree



Research Topics

The main topic of research is the intelligent robotics from the aspects of mechanical design, motion control and planning, computer vision, artificial intelligence, and automation.

1. Aerial Manipulation

A unique skill of the articulated aerial robot is the ability to perform arm manipulation [1] using the articulated structure as shown in Fig.1. The main challenges to achieve this ability is the flight control and motion planning based on the methodology of multi-rigid-body kinematics and dynamics.

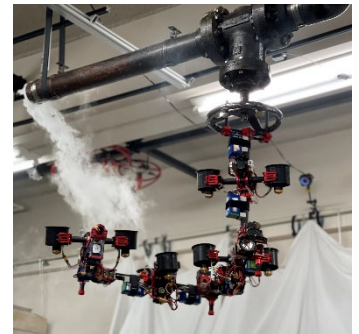


Figure 1 Aerial manipulation by our articulated aerial robot.

2. Meta-morphic Modular Robots for Multi-modal Locomotion and Manipulation

We are developing a self-reconfigurable modular robot platform that can enable multi-modal locomotion and manipulation as shown in Fig2. A novel quadruped robot called SPIDAR [23] that can both walk and fly, is our preliminary achievement of this topic.



Figure 2 Meta-morphic Modular Robot that can perform multi-modal locomotion and manipulation.

3. Archeology with Robotics

This is an entirely new field that is aimed at revealing the mechanism of human imagination regarding fantasy creatures and myths, such as dragon. Robots are used as the medium to imitate the configuration and motion, and then extract the unique features that form the key concept of the fantasy creature.

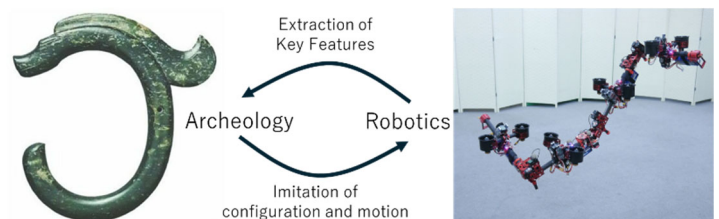


Figure 3 Left: C-shaped dragon from northeastern China (3500 BC). Right: Our DRAGON aerial robot [3].

Articles Related to Research Topics

- [1] Zhao M, Okada K, Inaba M. Versatile articulated aerial robot DRAGON: Aerial manipulation and grasping by vectorable thrust control. The International Journal of Robotics Research. 2023;42(4-5):214-248
- [2] M. Zhao, T. Anzai and T. Nishio, "Design, Modeling, and Control of a Quadruped Robot SPIDAR: Spherically Vectorable and Distributed Rotors Assisted Air-Ground Quadruped Robot," in IEEE Robotics and Automation Letters, vol. 8, no. 7, pp. 3923-3930, July 2023.
- [3] M. Zhao, et al, Design, Modeling, and Control of an Aerial Robot DRAGON: A Dual-Rotor-Embedded Multilink Robot With the Ability of Multi-Degree-of-Freedom Aerial Transformation, IEEE RA-Letters, vol. 3, no. 2, (2018).