# Master/BachelorThesis - Semester Project

## *Space Robotics*

## Background

Space robotics research emerges from the need for safe and efficient space exploration. Because human missions are costly and risky, robots are increasingly used to perform tasks such as satellite servicing, space station maintenance, and planetary exploration. Advances in robotics, sensing, and artificial intelligence have enabled space robots to operate with higher autonomy and reliability in extreme space environments, making them essential for future deep-space missions.

## Your Tasks

In this thesis, your jobs can be selected from the following tasks or your own ideas relative to this topic. To be specific:

### 1. Mechanical Structure Design

If you are proficient in **mechanical engineering and automation**, I would like you to **design a reasonable robot** capable of autonomous mobility and operation for a specific task in a specific scenario. The robot may take any form you consider appropriate and necessary, such as a wheeled robot, a legged robot, an aerial vehicle, a propulsion-based system, or other suitable configurations.

### 2. Simulator

If you are an expert in **reinforcement learning**, I would like you to **design a simulator** based on Isaac Sim, etc. for robot navigation and cooperation in space scenarios. You may build the environment from any relevant angle, such as modeling the space environment, low-gravity conditions, or other space-specific factors.

### 3. Computer Vision or Robotics Tasks

If you are interested in **coding**, I would like you to experiment with **generative models, vision models, or robot motion models** in space scenarios. You may start with simple modifications to improve performance. Please collect existing space-scene datasets, analyze their data distributions and model performance, and identify key challenges and issues. You can explore topics such as occupancy (OCC), world models, SLAM, and related methods in space environments.

## Requirements

You should have a solid foundation in robotics and computer vision, be proficient in communication and coding, and maintain an optimistic and proactive attitude.

## Contact

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[1] https://developer.nvidia.cn/isaac/sim

[2] https://www.nasa.gov/robotics.

[3] Gao Y, Chien S. Review on space robotics: Toward top-level science through space exploration[J]. Science Robotics, 2017, 2(7): eaan5074.