Department of Aerospace Engineering & Course of Aerospace Engineering
Space Structures/Astronautical Engineering

MAKIHARA Laboratory

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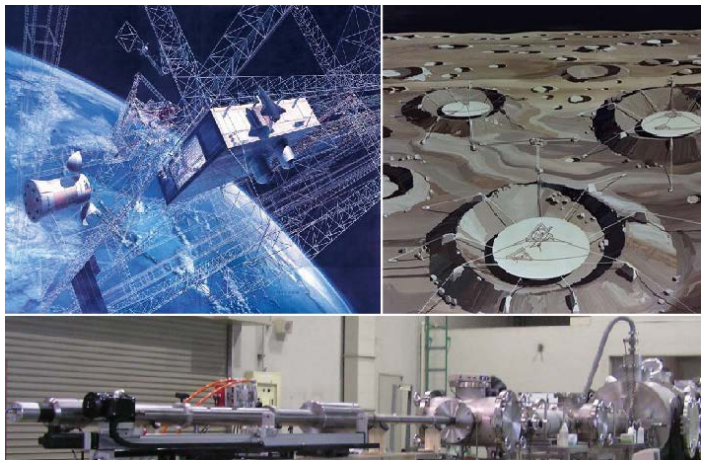

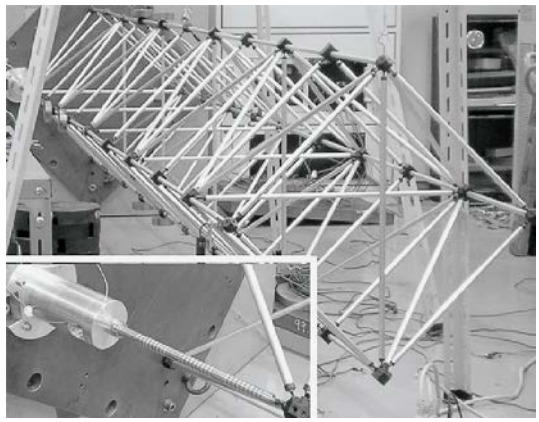

Space truss structure simulating a part of space station

Top-left: Next-generation space station, Top-right: Lunar observation base using moon craters
Bottom: Hypervelocity impact experiments conducted in JAXA

Vibration Control, Noise Control, Shock Control of Space Structures

We have developed vibration control, acoustic control, and shock control for space structures such as space stations, lunar bases, and artificial satellites. In space, sufficient power supply is not expected. Thus, an innovative method is required to suppress structural vibration using a self-powered control device. Our laboratory focuses on a truss structure that forms a structural member for next-generation space stations. We have installed a truss structure in our laboratory, which is employed for proof experiments.

- Self-powered vibration control for spacecraft (Enumerated items are research subjects)
- Proof experiment using space truss structures
- Shock attenuation of artificial satellites during launch period
- Noise reduction of rocket fairings

Energy-Harvesting Using Smart Structures

We cannot solely rely on solar power generation on the moon because night time occurs for up to 14 days. Therefore, energy harvesting from vibration sources should be explored. We are developing an energy harvester that is utilized not only in space structures but also in airplanes and automobiles.

- Energy-harvesting using smart space structures
- Development of autonomous digital harvesters

Experiments for Space-Debris Impacts

The impact of space debris and meteorites is a serious issue for space structures. We have implemented measures to mitigate hypervelocity impact in collaboration with JAXA and Aoyama Gakuin University. We are investigating the use of a conductive tether system for debris removal.

- Protection of space station against space debris
- Impact-proof tether systems for debris removal

Modeling for Variable Morphing Wings

Next-generation aircraft are expected to have a variable wing (morphing wing) to achieve fuel efficiency and compactness. We integrated three fields (fluid, structure, and control) to establish a coupling model for variable wings.

- Mars-airplane with folding wings
- Modeling of variable morphing wings

Dynamics Analysis for Aerospace Structures

For future aerospace structures, an innovative structural analysis is necessary, which differs from conventional frameworks. We conduct pioneering research for future space development.

- Attitude analysis of mass-varying spacecraft
- Shape control of large deployable antennas