Daiki Kousaka

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Space Structure Systems

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EDUCATION

Master of Engineering in Aerospace Engineering — Expected in March, 2019
Nihon University, Chiba, Japan
Bachelor of Engineering in Aerospace Engineering — March, 2017
Nihon University, Chiba, Japan
Sugito High School, Saitama, Japan — March, 2013

LISENCE

Amateur Third-Class Radio Operator

PRESENTATION

[1] Yasuyuki Miyazaki, Momoko Fukunaga, Daiki Kousaka, Membrane Structure Supported by Self-Deployable Truss for Space Applications, 2018 AIAA Spacecraft Structure Conferrence, AIAA Scitech Forum, AIAA 2018-1201, pp.1-13, 8-12 January 2018, Kissimmee, Florida, USA, DOI:https://doi.org/10.2514/6.2018-1201.(Oral)

[2] Daiki Kousaka, Yasuyuki Miyazaki, Development of Conceptual Model of Self-Deployable Truss Structure Consisting of Bi-Convex Booms, The 59th Structure Conference, 1A15, pp.1-3, 3-5 August 2017, AOSSA Fukui City Regional Interaction Plaza, Fukui, Fukui.(Oral)

AWARDS

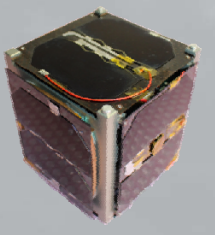
[1] Daiki Kousaka, Daishi Kawarabayashi, Momoko Fukunaga, Membrane Deployment De-orbit Device Composed of Self-Deployable Truss Structure, 2nd Debris Mitigation Competition, First Place, University of Rome, Rome, Italy, 4 December, 2017.

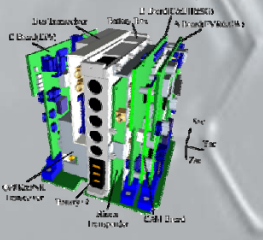
[2] Daiki Kousaka, College of Science and Technology Nihon University Academic Dean's Award, 14 March 2016.

DEVELOPMENT AND RESEARCH EXPERIENCE

①Micro Artificial Satellite "NEXUS" Development Project

Since March 2016, I participate in the development of the micro artificial satellite project "NEXUS". I'm in charge of thermal/structural system and power supply system. "NEXUS" is adopted as an innovative satellite technology demonstration program undertaken by JAXA and is scheduled to be launched during FY 2018. As of July 2018, we are developing a flight model.





②Bachelor's and Master's Research

Self-deployable truss structure is superior in storability and deployability, and has attracted attention as one of the applications applicable to large space structure such as space solar power system. This fabric pattern has constructed a truss structure using a self-extensible boom such as a bi-convex boom which is a combination of two convex tapes, and has a simple structure that doesn't require an actuator. However, as a problem with the realization of the self-deployable structure, the design method is not established. So, I propose an efficient storage and deployment method based on geometric design in the bachelor's research, and evaluated the validity of design by experiment. In the master's research, I'm conducting research to establish a deployment mechanism and deployment system of self-deployable structure with simple and certainty for space demonstration.

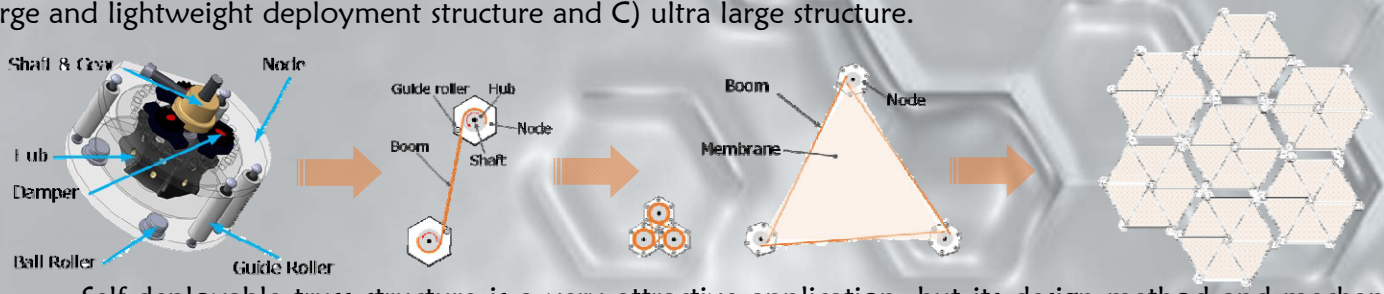
-RESEARCH SUMMARY-

Along with the advancement of missions, demands for space structures have also diversified, and from recent research trends in Japan and abroad, structures that have the following four characteristics are required for future space structures.

A) **Large & ultra lightweight structure** Ex) Solar sail etc.
B) **Large & lightweight deployment structure** Ex) Starshade etc.
C) **Ultra large structure** Ex) SSPS etc.
D) **Large & ultra high accuracy structure** Ex) Antenna etc.

Starshade SSPS

Many applications have been proposed for these structures, but due to the difficulty of ground experiments and the inability to design methods, their feasibility is poor. Large space structures must be excellent in storability and developability from the constraints of rockets. Among them, a self-deployable structure using a self-extensible boom such as a convex tape has attracted attention. Self-deployable structures are expected to be applied to space structures due to their high lightness and specific rigidity. Our laboratory has designed and proposed a self-deployable truss structure consisting of ① node, ② hub, ③ self-extending boom, ④ membrane. In the self-deployable truss structure, it is possible to construct a structure of several tens of meters by forming truss structures by combining nodes and joining them together. Furthermore, by further docking them, it becomes a structure of several kilometers class, and it is considered to be applicable to B) large and lightweight deployment structure and C) ultra large structure.



Self-deployable truss structure is a very attractive application, but its design method and mechanism hasn't been established yet, design has been done in a fumbling state. For this reason, it is easy for situations where feedback is repeated many times, and it is inevitable that deployment reliability is low unless it is a design that sufficiently secures a margin. Therefore, I thought that the necessity of the design standard of the self-deployable truss structure, the so-called "specification book" was high. In addition, I thinking that I have to verify whether it is a design applicable to actual space missions.


24N42B
(24 Nodes and
42 Booms)


7N12B


3N3B

Similar structure style.
However, different mechanisms...
It is necessary to unify them !!

It is necessary to show that self-deployable truss structure is effective in outer space, and that it is feasible as application of large space structure of several tens of meters in the future. Therefore, I will do the structural design of the 10 m class starshade using the self-deployable truss structure considering the demonstration on the HTV-X platform. I plan to reflect this design content as contents of the specification sheet. As a concrete content, design and evaluate a truss shape that can satisfy the structural requirements necessary for starshade. At this time, the structural elements of the self-deployable truss structure are made into a material / mechanism having space environment resistance, and a model that works reliably is constructed. Experimental verification under gravity and extreme environments will be conducted and the validity will be evaluated.