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Miyazaki & Yamazaki Lab.
Space Structure Systems Laboratory

▪Education

- ✓ **Graduate School of Science and Technology, Nihon University**
  2019-current Master Course of Engineering
- ✓ College of Science and Technology, Nihon University, Chiba, Japan, Bachelor of Engineering, March, 2018
- ✓ Chiba municipal Chiba High School, Chiba, Japan March, 2013

▪Qualification

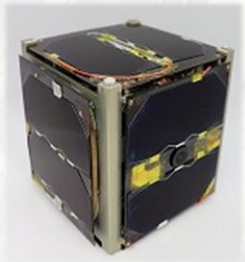
- ✓ Amateur Third-Class Radio Operator

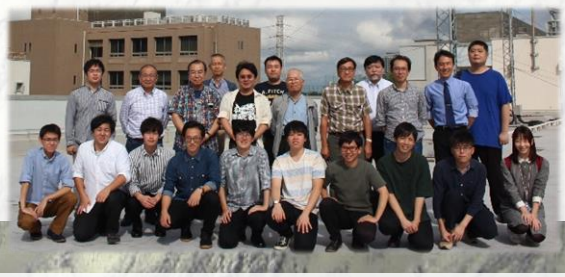
▪Research and Development Experience

I had participated in "Satellite Project" of Miyazaki & Yamazaki Laboratory since the first year in undergraduate school of the university, and learned the foundations of micro satellite. I participated in development test of large deployment structure studied in this laboratory since the third year, and have learned about large space structures. Among them, I am interested in analyzing the deployment behavior of deployment structures using numerical simulation. In the third year, I participated in seminars aimed at learning the dynamics of the membrane structure, and I have learned the foundation of nonlinear finite element method. Currently, I am researching on " Transient response and natural vibration characteristics of Self-deployable membrane truss structure". In addition, I have been participating in the development of the amateur communication technology demonstration satellite "NEXUS" since the fourth year. And from November 2018, I lead a project as a project manager.

▪NEXUS Project

NEXUS is CubeSat developed jointly with Nihon University and JAMSAT (The Japan Amateur Satellite Association). NEXUS was adopted as JAXA's **"Innovative Satellite Technology Demonstration Program"** and It was launched together with six satellites from JAXA's Uchinoura Space Center, at 00:50:20 AM (UTC), January 18, 2019. To date, we have demonstrated the operation of a newly developed amateur transceiver (**π / 4 shift QPSK transmitter, FSK transmitter, linear transponder**). In addition, we have taken images using the small and highly versatile camera system **(N-CAM)** developed for CubeSat, and obtained the earth image as shown on the right.





NEXUS homepage

http://sat.aero.cst.nihon-u.ac.jp/nexus/0_Top.html

▪Conference presentation

- ✓ Koichiro Yamada, NEXUS Development team, Yasuyuki Miyazaki, 62th Space Science and Technology Conference, "Preparation Status for Launch of Amateur Communication Technology Demonstration Satellite NEXUS"

・Research Profile

“Transient response and natural vibration characteristics of Self-deployable membrane truss structure”

In recent years, among the more diversified and complex space missions, the demand for larger and lighter deployable structures is increasing. Gossamer structure has attracted attention for realizing these structures. The gossamer structure is an extremely light or thin structure. Self-Deployable Membrane Truss structure(SDMT) using BCON boom with convex cross section as shown Fig.1 has attracted attention due to the following advantages.

1. High storage efficiency
2. It’s lightweight because it uses a thin member
3. Since it has self-extending power by springiness, it doesn’t require power for deployment
4. The deployment method is simple
5. Stiffness after deployment can be ensured by the latch mechanism.
6. By modularization, it can adapt to various shapes.

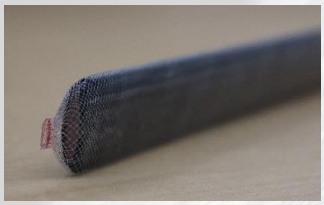


Fig.1 BCON Boom

In our laboratory, in order to demonstrate SDMT in orbit, application to actual applications such as Starshade, SSPS[1] and Debris Catcher is proposed[2][3].
Although previous researches have made it possible to compensate for the development of SDMT [4], however the shape and rigidity after deployment have not been evaluated yet. Therefore, the purpose of this research is **to clarify the shape accuracy and rigidity for disturbance after the development of SDMT, and to show that it can be applied to the actual on-orbit mission**. In this research, 7N12B model (7 nodes, 12 booms) is set as the analysis target, and transient response analysis and natural vibration analysis will be performed using the finite element method. So far, as shown in Fig. 2, I created an analysis model similar to the SDMT of the actual 7N12B model using Matlab @ MathWorks, and derived the equilibrium state after deployment.

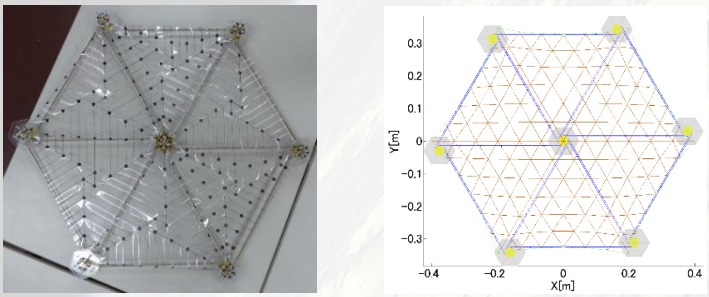


Fig.2 7N12B Analysis model

In the future, transient response analysis and natural vibration analysis will be performed under various conditions using the created model. In parallel, we will develop an analysis model of the SDMT of the Starshade model and perform the same analysis to show the on-orbit feasibility of the SDMT.

Reference

[1]John C. Mankins, SPS-ALPHA: The First Practical Solar Power Satellite via Arbitrarily Large Phased Array, NASA Innovative Advanced Concepts Program NIAC Phase 1 Final Report, 2012

[2]S.Shitara, Y. Miyazaki, T.Nakamura, D.Kousaka, M.Fukunaga, 62th Space Science and Technology Conference, “Shape of Starshade using Self-Deployable Membrane Truss”

[3]D.Kawarabayashi, H.Matsuura, Y.Miyazaki, , 62th Space Science and Technology Conference, “The Structural Characteristics of Three-dimensional Truss Using a Self-Extensible Boom”

[4]M.Fukunaga, Y.Miyazaki, S.Shitara, D.Kousaka, D.Kawarabayashi, AIAAScitech 2019 Forum, “Design Method of Self-deployable Truss to Prevent Jamming of Stored Booms”