



KOICHIRO YAMADA

Phone: (+81)-047-469-5430

Email: csko18020@g.nihon-u.ac.jp

MIYAZAKI & YAMAZAKI LAB.
Space Structure Systems Laboratory



• Education

- ✓ Graduate School of Science and Technology, Nihon University
2018-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

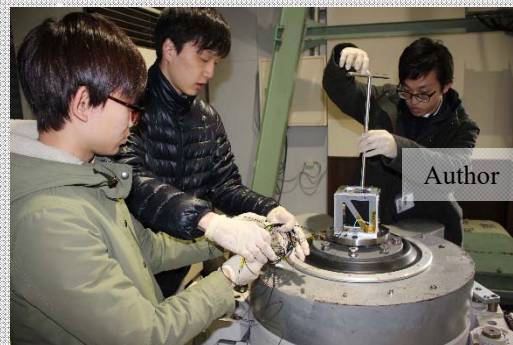
- ✓ Amateur Third-Class Radio Operator

• 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 "Deployment Behavior of Self-Deployable Truss Structure". In addition, I have been participating in the development of the amateur communication technology demonstration satellite "NEXUS" since the fourth year, in order to learn "making things that are valuable for use in space" through satellite development. NEXUS is under development now and I am in charge of EPS. Last fiscal year we fabricated the EM of NEXUS, conducted the environmental testing, and fabricated the FM. The NEXUS project is approaching the final stage of FM development. NEXUS will be launched by JAXA's Epsilon rocket #4 in the end of 2018.



Deployment test of Self-Deployable Structure



Vibration test of "NEXUS"



• About "NEXUS"

NEXUS is a CubeSat aimed at demonstrating the operation of **two types of high-speed communication devices, a linear transponder, and A high versatility camera system.**



Launch at the end of 2018 Coming Soon...

• Research Profile

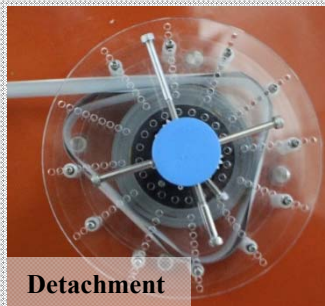
“Deployment Behavior of Self-Deployable Truss Structure”

In the space development field, the demand for larger and lighter deployment structures has been increasing with the advancement and diversification of missions, and the gossamer structure attracts attention to realize them. Gossamer structure is a very lightweight thin structure, and inflatable tubes and membrane structures are just examples. Among them, self-deployable truss structure using convex booms has been drawing attention in recent years because

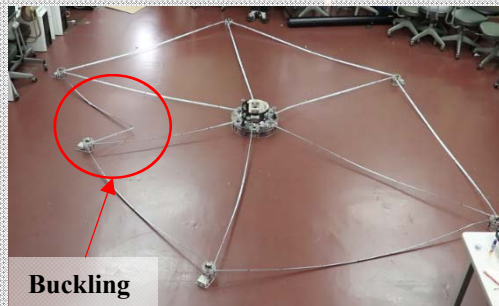
1. **High storage efficiency**
2. It's **lightweight** because it uses a thin member
3. Since it has **self-extending power** by springiness, it doesn't require power for deployment
4. The deployment method is **simple**

However, self-deployable truss structures using lightweight and thin members are susceptible to air drag and gravity. It may show totally different deployment behavior between on orbit and on the ground. Therefore, in order to show the feasibility of the self-deployable truss structure in space, **it is indispensable to predict deployment behavior not only by ground experiment but also by numerical calculation.**

In our laboratory, the prediction of the deployment behavior was made under the ideal condition, i.e. each boom extends straightly and synchronously with each other, and does not buckle, but **the deployment tests on the ground had troubles such as buckling of the boom and stopping of development due to the detachment of the boom.**



Detachment



Buckling

By constructing a deployment analysis model that takes these problems into consideration and predicting deployment behaviors based on these model, it is possible to derive design parameters that ensure the deployment without causing those problems. In addition, because ground experiments of large models are difficult considering experimental locations and costs, **I am proposing a mechanism that ensures deployment in space through ground experiments of small models and prediction of deployment behaviors of large models by numerical simulation.**

Currently, I am preparing analytical models and formulating equations of motion for 2N1B model which is a unit structure of self-deployable truss structure. In the future, I will show the deployment behavior prediction using the created model and the validity of the analytical model by comparing it with the ground experiment in the model which matched the parameters with the prediction. After that, I apply analytical models to 3N3B models and models with a membrane in a self-deployable truss structure.

In addition, at our laboratory, we are aiming to adapt self-deployable truss to Starshade and to demonstrate the space utilization feasibility of the self-deployable structure, and we are developing the small demonstration machine of Startshade. Among them, **I aim to show that deployment behavior analytical model is applied to Starshade and that it can be reliably deployed in space.**

Deployment behavior analysis of ...



2N1B



3N3B



With membrane



Starshade