



EDUCATION

- Master of Engineering, Nihon University, Chiba Funabashi, 2018-current
- Bachelor of Engineering, Nihon University, Chiba Funabashi, March, 2018

QUALIFICATIONS

- First kyu soroban license (2008)

AWARD

- Award from the faculty of science and engineering (2018)

RESEARCH

- My research is **Data Driven Modeling For Membrane Space Structure.**

Background

- Small solar power sail demonstrator “IKAROS” (Fig. 1) was launched by JAXA in 2010. In order to reliably deploy the structure in which membrane is attached to the deployment support structure like “IKAROS “ in orbit, behavior estimation technology is essential. But **ground experiments are difficult** as the technology. **So it is essential to estimate the behavior of these structures by numerical analysis.**
- As a numerical analysis method, a nonlinear finite element method based on the Energy Momentum Method (EMM) was proposed, and the validity of it is evaluated by comparison with orbital data of IKAROS. However, this method has a problem of **high calculation cost**

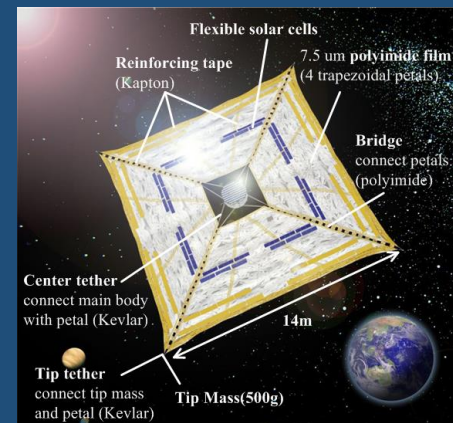


Fig.1 IKAROS

Approach

- To that problem, until now, our laboratory have aimed for improvement of the problem by selecting a low-dimensional subspace from past numerical analysis data, solving a numerical analysis model on a low-dimensional subspace, and reducing **spatial complexity.**
- However, since iterative calculation like Newton method is conducted, we think that if the number of iteration decreases, further calculation time can be improved. So we aim for further improvement **by forecasting a valid initial value** for iterative calculation from the information in the time domain of the Reduced Order Model(ROM) and reducing **temporal complexity.**

Result

- We applied this method to simple model assuming space structure(Fig.2) and found that ROM which forecast the valid initial value of Newton method shows almost no error behavior for ROM(Fig.3). So, we compared the total number of iterative calculations in full model, ROM, and ROM with forecasting the valid initial value and found that the number of iterative calculations decreases by reducing the spatial complexity, and furthermore, by reducing the time complexity, **it can be reduced by about 50%.**

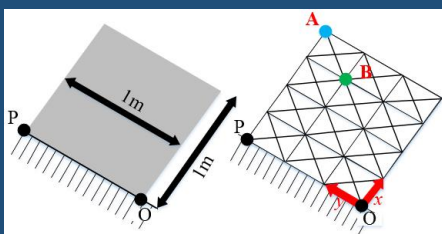


Fig.2 Simple model

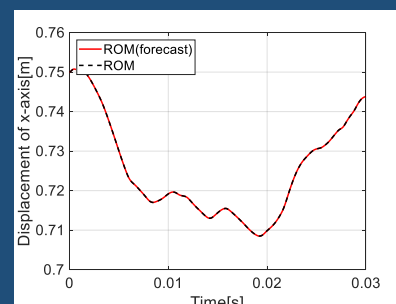


Fig.3 Comparison of displacement in Node B of ROM and ROM with forecasting

- We think the improvement of calculation cost can be expected by reducing the number of iterative calculations.

Future Plan

- We will apply this method to a model like IKAROS and confirm whether the calculation cost is improved while keeping constant accuracy for the full model. And we will apply this method using multiple prior data obtained for multiple parameter inputs. Because we lead ROM using data obtained from a simulation based on a certain parameter and use the model at the actual design stage to calculate with other parameters to obtain an approximate solution.
- Finally we aim to develop a modeling method that can lead optimal design solution with realistic calculation time

PROJECT

- Now, I participate in two projects. One is **HEPTA-Sat**, the other is **Prelude**

HEPTA-Sat

- HEPTA stands for “**H**ands-on **E**ducation **P**rogram for **T**echnical **A**dvancement”. Our laboratory developed this HEPTA-Sat(Fig.4) so that people who are interested in space engineering can learn it.

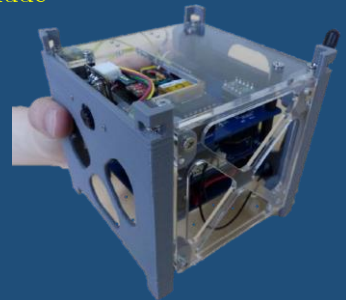


Fig.4 HEPTA-Sat kit

Overview

- HEPTA-Sat is composed of 6 function and 6 primary subsystems(Fig.6) like a real satellite. People can learn **how each subsystem functions** and **how to integrate subsystems** into a satellite through experiencing the process of **assembly, integration** including programing & system implementation and **test** in HEPTA-Sat hands-on training course.

My activities

- I was mainly in charge of developing software such as sensor subsystem of HEPTA-Sat. So I participated in some exhibition like Maker Faire as a explainer(Fig.7) and some workshops as a Teaching Assistant(Fig.7).

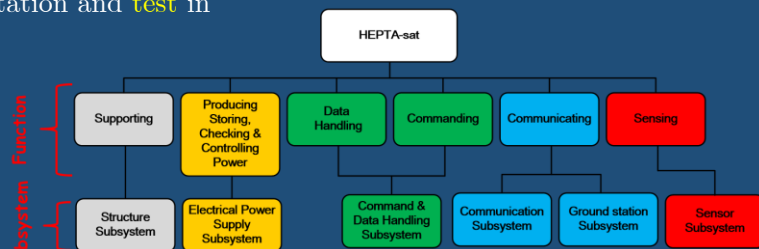


Fig.5 HEPTA-Sat function and system diagram



Fig.6 My activities (left : Maker Faire Tokyo, middle : CLTP, right : Bulgaria workshop)

Prelude

- Prelude stands for “**P**recursory **e**lectric field observation **c**ubesat **d**emonstrator”(Fig.7).

Overview

- Recently, it was found that the phenomenon of preceding abnormality of the ionosphere caused by the earthquake was statistically significant. So we will develop small satellite “Prelude” and aim to **predict global earthquake occurrence** by global observation of satellites using VLF sensor.

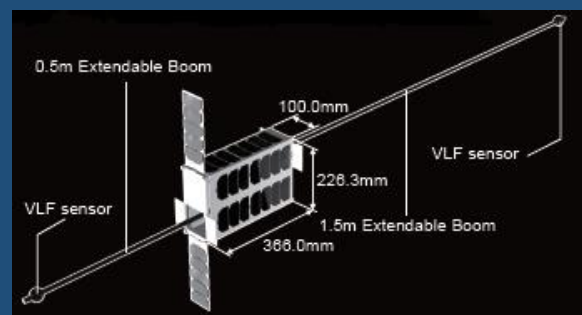


Fig.7 Prelude

My activities

- In this project, I’m in charge of communication subsystem and attitude determination and control subsystem.
- Now, I’m developing satellite Bread Board Model.