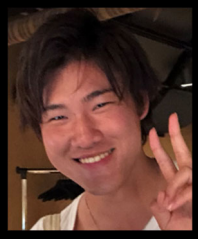
Miyazaki Yamazaki Lab, Dept. Aerospace Engineering
Col. Science and Technology, Nihon University

Asuka Tatara



Phone:+81-047-469-5430
E-mail:tatara@forth.aero.cst.nihon-u.ac.jp

EDUCATION

- Master of Engineering in Aerospace Engineering
  Nihon University, Funabashi, Chiba, accelerated promotion — current
- Bachelor of Engineering in Aerospace Engineering
  Nihon University, Funabashi, Chiba, dropout — March, 2019
- Nagaoka High School, Nagaoka, Niigata — March, 2016

Research Keyword

Solar sail, IKAROS, OKEANOS, crease stiffness, Finite Element Method
NEXUS, attitude analysis, rigid body

Research Theme

1. "Effect on crease stiffness for deployment of the spinning Solar sail"

Background

The solar power sail; IKAROS[Interplanetary Kite-Craft Accelerated by Radiation Of the Sun, fig.1] was launched in 2010, and deployment of the 14m-sized membrane was successful in 2011. JAXA proposes the next solar power sail, which has 40m-sized membrane, OKEANOS [Outsized Kite-craft for Exploration and AstroNautics in the Outer Solar system, fig.2] in 2020s.

Those are the gossamer structure characterized by large area and super lightweight. Therefore it is difficult to conduct the ground experiment on the dynamics of membrane. So, numerical analysis is essential to predict dynamic behavior in space.

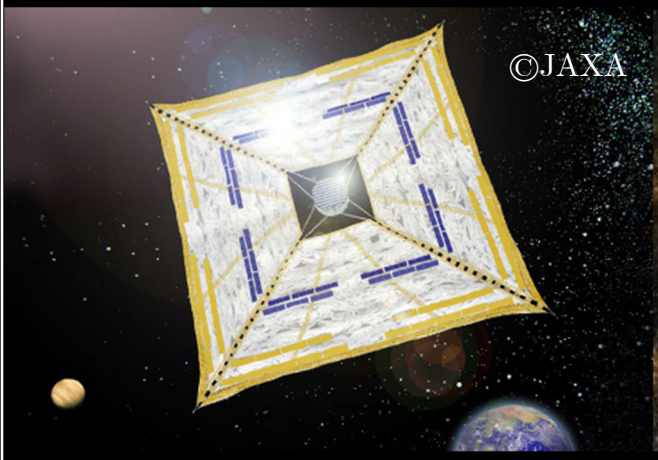


Fig.1 IKAROS

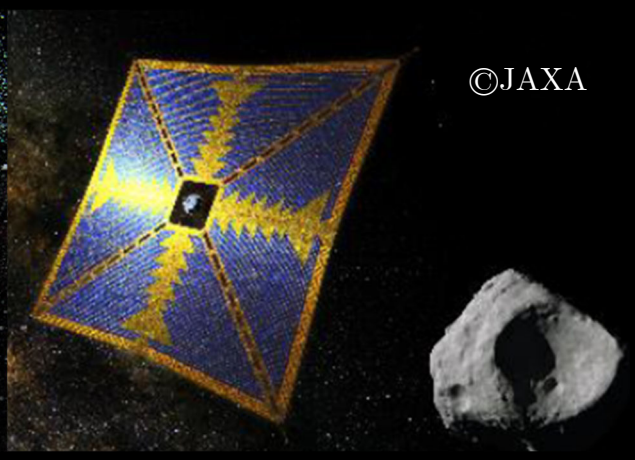


Fig.2 OKEANOS

Current Research and Future Plan

My Research theme is "Effect on crease stiffness for deployment of the spinning Solar sail". When membrane is creased, the points of a crease increase stiffness. This is called "crease stiffness", which must be considered in membrane structure. This research purpose is the evaluation that the increase of crease stiffness affect dynamic behavior of

the deployment of solar power sail.

First, the numerical analysis model as Fig.3 is applied. Energy of crease is decided by θ in Fig.3. Furthermore, I give this model the variation in crease stiffness based on the normal distribution, and evaluate the validity of the model in comparison with the ground experiment.

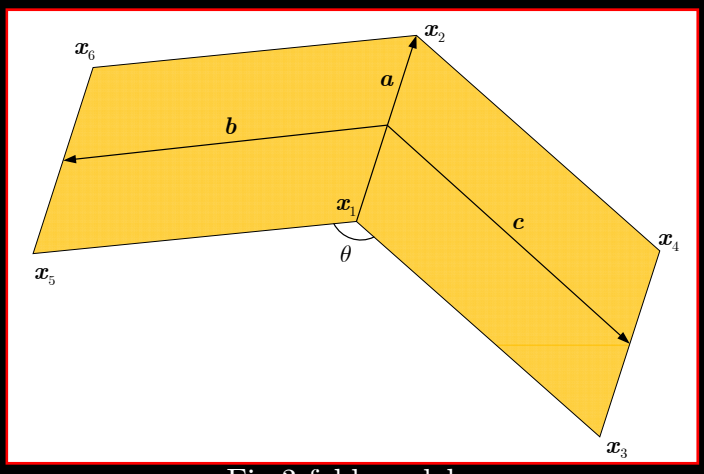


Fig.3 fold model

Second, this fold model is applied to solar power sail, and I will evaluate the effect on the variation of crease stiffness for deployment of the Solar sail. Furthermore, I will investigate the variation in crease stiffness that membrane of Solar sail can be deployed.

2."Attitude analysis of the Cube-Sat NEXUS"

The Cube-Sat, "NEXUS[Next generation X(cross) Unique Satellite]" projected by Miyazaki/Yamazaki lab was launched in 18th January, 2019. This satellite steadily has succeeded missions, but it has some of problems. One of the problem is increase of the angular velocity by magnetic torque. This research is the cause investigation of increase of angular velocity, and to find out the operation which reduces its angular velocity.

I analyzed the motion of NEXUS which was regarded as a rigid body.

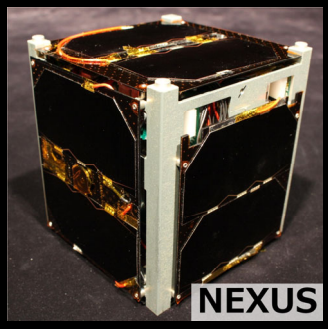


Fig.4 NEXUS

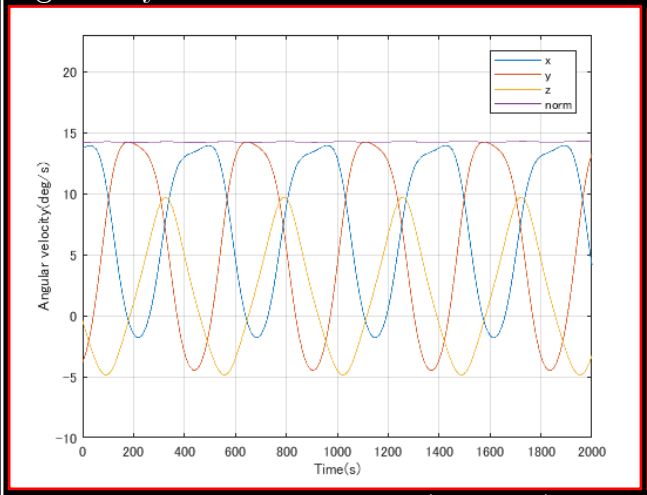


Fig.5 Angular velocity(analysis)

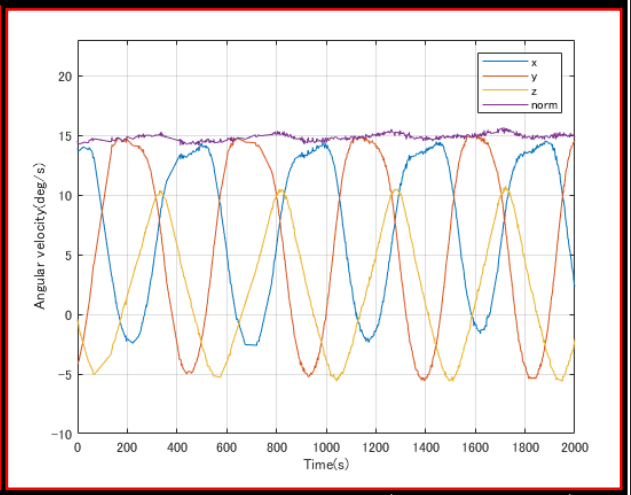


Fig.6 Angular velocity(sensing data)

Angular velocity of numerical analysis is practically matching with that obtained in orbit. I will create programs which make it possible to estimated magnetic torque.