

Miyazaki & Yamazaki Lab.
Space Structure Systems Laboratory



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QUALIFICATIONS

- CATIA V5R18 Part Design Specialist
- CATIA V5R18 Assembly Design Specialist
- Amateur Third-Class Radio Operator

EDUCATION

- Master of Engineering in Aerospace Engineering, Nihon University, Chiba, 2017-current
- Bachelor of Engineering in Aerospace Engineering, Nihon University, Chiba, 2013-2017
- Certificate for Students Achieving the Proficiency Level of Upper Secondary School Graduates, 2009
- Tsuchiura Daiichi High School, Ibaraki, drop out ... (; D ;), 2008

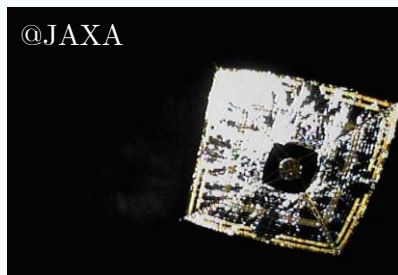
RESEARCH KEYWORD

Large Space Structure, Solar Sail, IKAROS, OKEANOS, ANCF

RESEARCH OVERVIEW

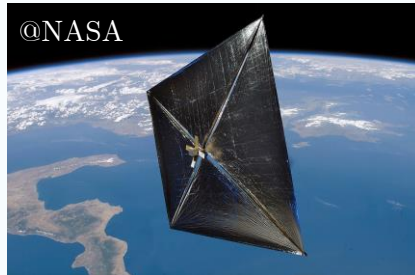
1. Solar sail

In recent years, large scale space structures of several ten meters or several kilometers has been receiving much attention from all over the world. Among them, I am conducting research on solar sail (IKAROS, OKEANOS). Solar sail is a space yacht that gains thrust by receiving solar light pressure in outer space. Solar sails are roughly divided into the following three categories.



@JAXA

Centrifugal Deployment Type
(IKAROS)



@NASA

Boom Deployment Type
(Nano-sail D2)



@NASA

Heliogyro
(HELIOS)

Examples of Solar sail

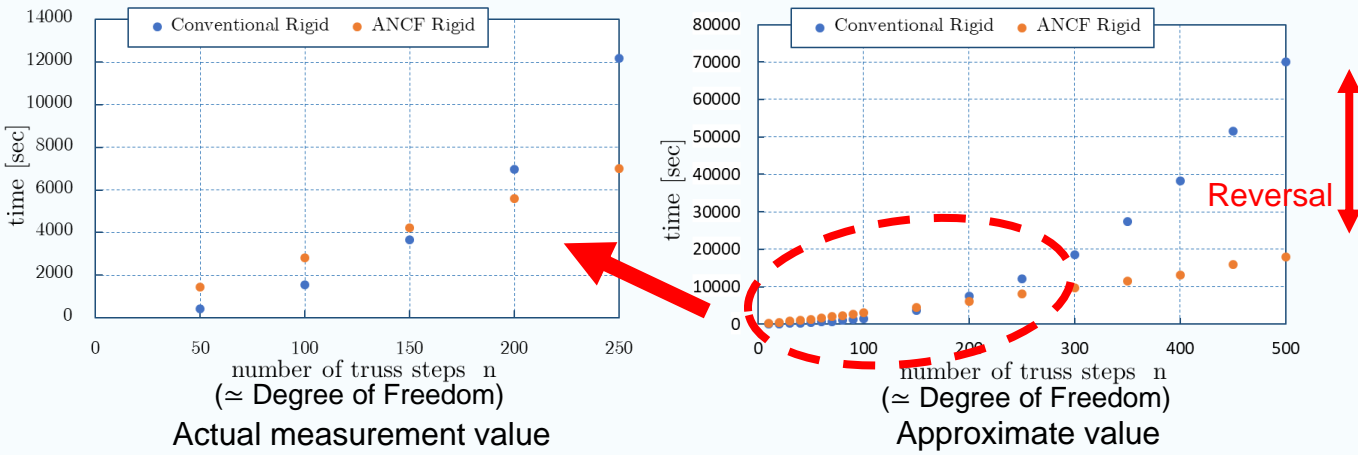
2. IKAROS, OKEANOS (Centrifugal Deployment Type)

The solar power sail IKAROS was launched in May, 2010 by JAXA, and the 14m sized sail membrane was successfully deployed in June, 2011. Currently, JAXA is considering the next solar power sail OKEANOS, which is much larger than IKAROS. IKAROS and OKEANOS are gossamer structures characterized by large area and super lightweight (Ex. membrane, cable). Because of these characteristics, it is difficult to experiment on the ground because it is affected by air resistance and gravity. So numerical analysis is indispensable to predict the dynamic behavior and static equilibrium shape of the structure in space.

RESEARCH OVERVIEW

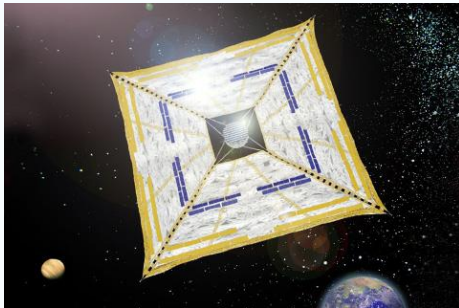
3. Research in Undergraduate

For the reasons described above, numerical simulation becomes important in design, but it requires not only analysis accuracy but also simulation speed enough to withstand the design. Therefore, we aimed at shortening the numerical simulation time. In doing so, we calculated using the FEM method called ANCF, and confirmed that shortening of calculation time is realized along with increase in degree of freedom.

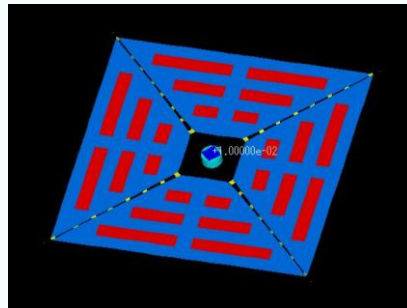


4. Research in Graduate School

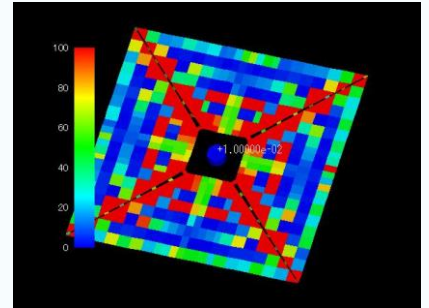
In IKAROS, the membrane surface shape of the solar sail caused unexpected deformation. It is thought that the cause is the warping of the solar cell pasted on the thin membrane. Therefore, using the ANCF shell element, we are thinking to simulate the warpage of the solar cell and calculate the shape of the solar sail. An example of the calculation is shown below.



Overview of IKAROS

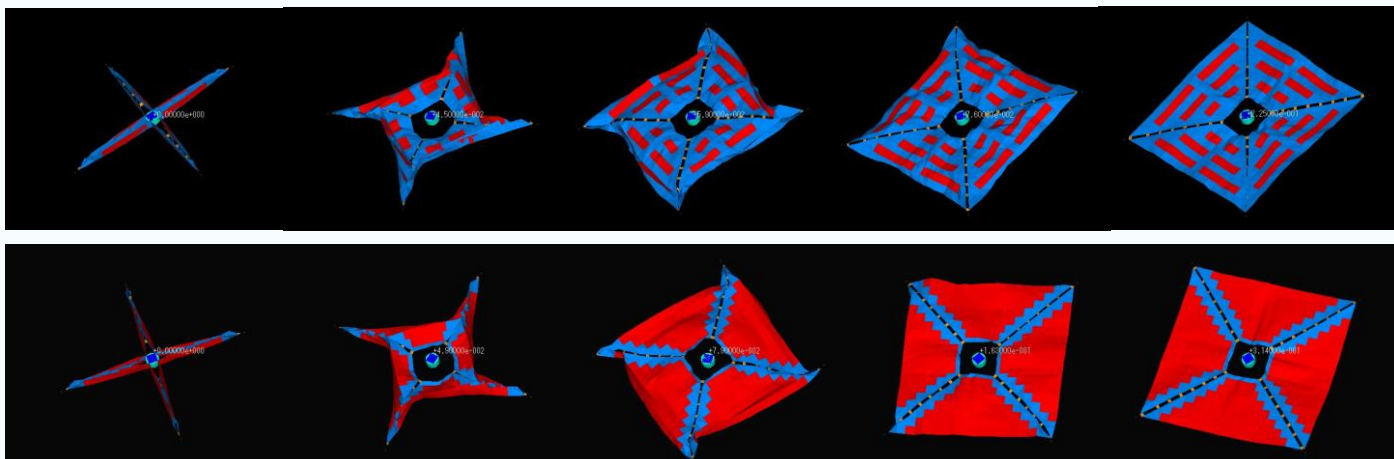


Overview of Simulation
(Red: cell, Blue: membrane)



Strain Energy Density

Also, by changing the rigidity of the membrane element, we calculate deployment behavior when solar cell is pasted on thin film as follows.



Deployment Sequence (Red: cell)