






Takeru Nakamura

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Education

2019 - present Master of Engineering in Aerospace Engineering, Nihon University, Funabashi, Chiba, Japan
2015 - 2019 Bachelor of Engineering, Nihon University, Funabashi, Chiba, Japan
2012 - 2015 Kumamoto Daini High School, Kumamoto, Japan

Qualification

Amateur 3rd-Class Radio Operator, 2019
Driver's License, 2015

Professional Society

2018 - present The Japan Society for Mechanical Engineers

Presentation

- [1] **Takeru Nakamura**, Shoichi Shitara, Yasuyuki Miyazaki, Mission Study of Starshade Technology Demonstration Satellite "Euryops", The 20th Space Science Symposium, P 1.70, 8-9 January 2020, ISAS JAXA Sagamihara Campus, Sagamihara, Kanagawa Japan (Poster)
- [2] **Takeru Nakamura**, Koichiro Yamada, Riku Sato, Ryota Nakamura, Hitomi Fujii, Yasuyuki Miyazaki, Amateur Satellite Communication Evaluation by CubeSat "NEXUS", IEICE Society Conference 2019, BI-3-3, pp.1-2, 10-13 September 2019, Osaka University, Toyonaka, Osaka, Japan (Oral)
- [3] **Takeru Nakamura**, Yasuyuki Miyazaki, Study of Orbit for Technology Demonstration of Starshade Using Micro-Satellite, The 29th Workshop on JAXA Astrodynamics and Flight Mechanics, C-10, pp.1-6, 22-23 July 2019, ISAS JAXA Sagamihara Campus, Sagamihara, Kanagawa Japan (Oral)
- [4] **Takeru Nakamura**, Shoichi Shitara, Seita Kataoka, Yasuyuki Miyazaki, Shape Sensitivity Analysis of Starshade Using Self-Deployable Membrane Truss, 32nd International Symposium on Space Technology and Science, 2019-c-13, pp.1-7, 15-21 June 2019, Fukui, Japan (Oral)
- [5] **Takeru Nakamura**, Yasuyuki Miyazaki, Performance Evaluation of Starshade Using Self-Deployable Membrane Truss, The Japan Society of Mechanical Engineers Kanto Branch 57th Graduation Research Presentation Conference, 316, pp.1-5, 18 March 2019, Chiba Institute Technology, Narashino, Chiba. (Oral)

Research Keyword

Starshade, Occulter, Self-Deployable Membrane Truss(SDMT), Exoplanet, CubeSat, Microsatellite

Research And Development Experience



CubeSat "NEXUS"

I participated in CubeSat "NEXUS" project as member of C&DH subsystem group from 2016. The launch succeeded in January 2019, I carried out satellite operation, demonstration of high speed transmitter and high performance camera system on orbit. I belong to space structure systems laboratory since 2018 and I have studied on design method of Starshade. I proposed a polygonal shape occulter for applying SDMT to the occulter. Currently, I'm a project manager of the starshade technology demonstration satellite "Euryops" and NEXUS.

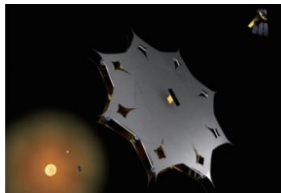
Research Overview

Theme : "Design Method of Starshade System Using SDMT"

I am researching on the design method of the Starshade system which is one of the observation methods of the exoplanets. Below is a detailed explanation of my research.

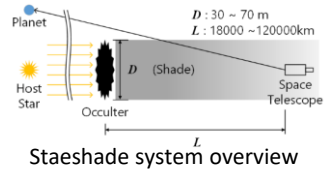
1. Exoplanet and Starshade

We call the planets outside the solar system "exoplanets", which orbit around the stars. One of the problems of exoplanet observation is too high intensity ratio between the host star light and the planetary light, and the Starshade system has been proposed as the solution to this problem.

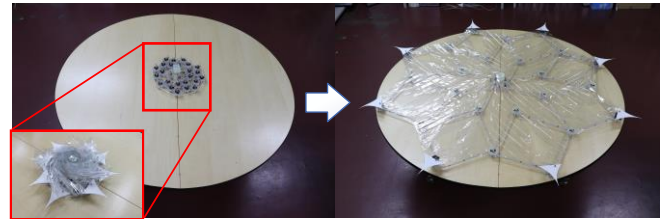


Starshade concept image

The Starshade system is a system that directly observes exoplanets by putting large stellar light shield called occulter between the space telescope and the star proposed by NASA/JPL.



SDMT is lightweight, and has superior storage and deployment capability, so that we consider it is the optimal structural form for composing occulter. We proposed a new polygonal shape for applying to SDMT structure.



Steward state ($\phi 0.47\text{m}$)

Deployed state ($\phi 2.32\text{m}$)

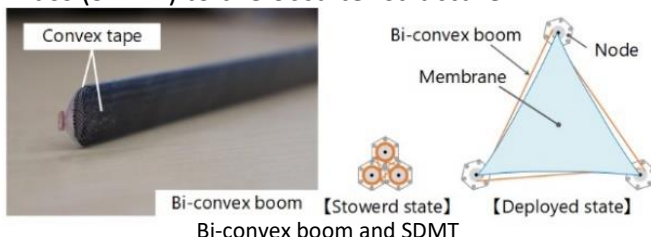
2. Currently Proposed Occulter



The shape of the currently proposed occulter is a petal shape which suppresses the diffraction of the stellar light as much as possible. Since this shape has a curved outline unsuitable for the deployment structure, the occulter is a very complex deployment style and its cost is expensive.

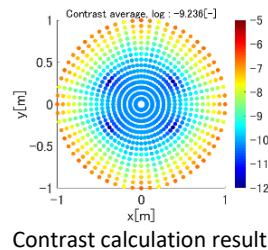
3. SDMT and Polygonal Occulter

In order to solve the above problems, we are working on applying Self-Deployable Membrane Truss (SDMT) to the occulter structure.



4. Starshade Technology Demonstration Mission "Euryops"

I found that the proposed occulter has the equivalent performance to the conventional occulter by the contrast calculation. As the next step, demonstration with microsatellite is required to confirm that the novel shape occulter is performing well and to prove that the starshade can be effective in orbit. Therefore, we are considering a technology demonstration of Starshade using micro-satellite called "Euryops", exozodiacal disk survey satellite using occulter composed of SDMT. Euryops consists of two micro-satellites, i.e. an occulter satellite and a telescope satellite. The mission will provide direct imaging of extrasolar dust disks at multiband.



Contrast calculation result

