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Education

- Master of Engineering in Aerospace Engineering expected in March, 2020
Nihon University, Funabashi, Chiba
- Bachelor of Engineering in Aerospace Engineering March, 2018
Nihon University, Funabashi, Chiba
- Morioka Daiichi High School, Morioka, Iwate March, 2013

Professional Society

- 2017 – present The Japan Society for Aeronautical and Space Sciences

Research Keyword

- Starshade, Occulter, High-contrast Imaging, Apodization

Presentation

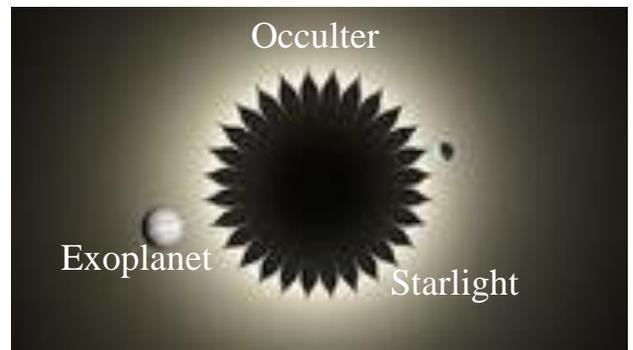
- Shoichi Shitara, Yasuyuki Miyazaki, Effect of Shape of Starshade on High-Contrast Imaging, SEC'17, 1A4, 2017/12/22-23, Hotel Maholova Minds Miura TOKYO BAY, Miura, Kanagawa, Japan. (Oral)

Research Overview

Theme : “Shape of Starshade using Self-deployable Truss”

1. What is Starshade?

Is there another planet that we can live? Is there an extraterrestrial life? In order to know that, we want to observe extrasolar planets. Many of them have been discovered by indirect observation methods, but direct observation is necessary to obtain detailed information on exoplanets. However, since the fixed star is so bright compared to the planet, the starlight disturbs the observation. For this reason, a system called starshade has been proposed that allows direct observation of the planet by blocking the starlight using a large membrane shield (occulter) placed between the fixed star and the space telescope.

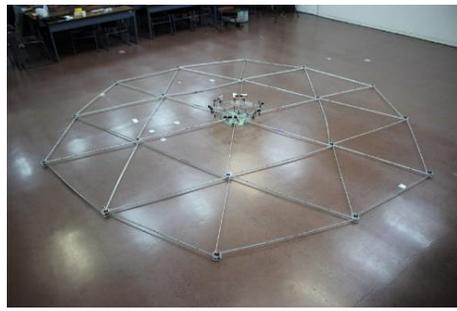


Starshade, <https://www.spaceanswers.com/wp-content/uploads/2014/12/Screen-Shot-2014-12-15-at-13.34.44.png>

Blocking the starlight, <https://exoplanets.nasa.gov/resources/1015/flower-power-nasa-reveals-spring-starshade-animation/>

2. Self-deployable Truss

We have been studying on a self-deployable truss composed of self-extensible booms that have high spring back effect and can be rolled-up into small volume. The proposed self-deployable truss does not use any powered actuator, and is a simple structure compared with the conventional deployable structures. In addition, we has proposed a theoretical design method of the self-deployable truss in previous studies, and validated the theory experimentally.



[24N42B(φ4.4m)]



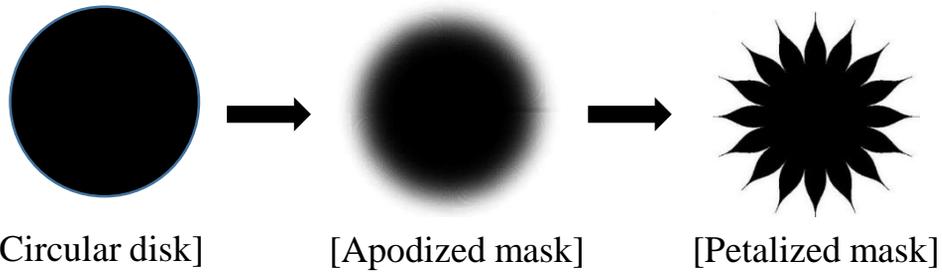
[3N3B(φ5m)]



[24N24B(φ20m)]

3. Shape of Occulter

If the occulter is a non-transmissive circular disk, Arago spot (Poisson spot) is generated at the center of the telescope pupil plane from Huygens-Fresnel principle. An apodized mask that gradually decreases the transmittance towards the edge of a circle is ideal for the occulter, but it is technically difficult to change the transmittance continuously. Therefore, an occulter like a flower petal (petalized mask) using the membrane with no transmittance is proposed that has equivalent transmittance with the ideal occulter.



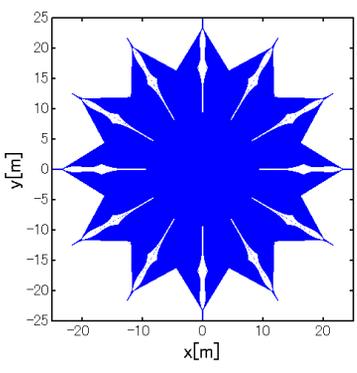
[Circular disk]

[Apodized mask]

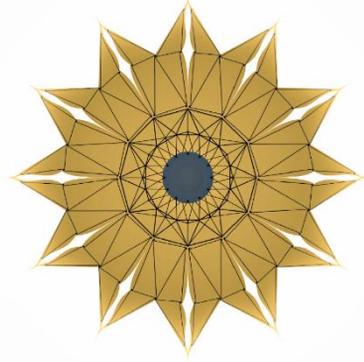
[Petalized mask]

4. Application of Self-deployable Truss

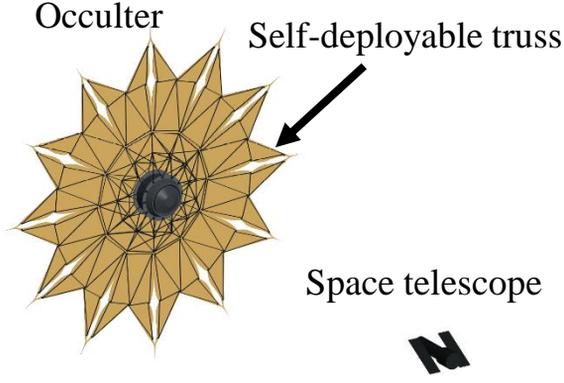
Since the booms constituting the self-deployable truss are extended in straight lines, it is difficult to express the curved shape like a flower petal. When using a self-deployable truss, it is better to make the outer shape of occulter polygonal line. So we obtained such occulter shapes by making the holes inside the occulter to set the angular width same as that of the petalized mask. I am considering applying the self-deployable truss to the starshade in such a method.



[Shape]



[Front view]



[3D view]

