[Initiatives by the Egami laboratory for developing a space elevator climber]

[Egami laboratory, Kanagawa University]

[Tadashi Egami. Kanagawa University. egami@kanagawa-u.ac.jp*,*
Toru Ikeuchi. Kanagawa University. t.ikeuchi.87@gmail.com*,*
Tetsuo Tsukuni. Kanagawa University.
tsukunitetsuo1986@yahoo.co.jp*]*

[In a space elevator, adjusting the pressing force that the wheels apply to the tether is critical in order to ensure that the climber ascends and descends smoothly without slipping. Accordingly, we developed a climber that is capable of autonomously adjusting the pressing force applied by the wheels. As a result, ascent and descent of the climber without idle turning of the wheels was successfully achieved.]

[Kanagawa University, 3-27-1, Rokkakubashi,
Kanagawa-ku, Yokohama, 221-8686 Japan]

[Choose a date.]

1. Introduction

Our university laboratory has been engaged in developing a space elevator climber for three years, our reseach forcuses on fundamental mechanisms that can ensure the stable ascent and descent of the climber. In 2009 and 2010, we participated in Japan Space Elevator Technical & Engineering Competition and our reseach was well received. We hope to gain valuable experience and a positive evaluation at the upcoming European Space Elevator Challenge as well.

2. The development-process of your Climber

2.1. Concept

The most important aspect of our climber's design is the construction of a system for stablizing the climber and propelling it up and down the tether. Idle turning of the wheels during ascent or descent of the climber not only causes energy loss in the climber, but also can damage the tether. For this reason, we developed a control system and a mechanism that uses a pressure sensor to monitor the pressing force applied to the tether by the wheels and automatically ajusts the pressing force with the aid of a stepping motor and a slide screw.

2.2. Design

A characteristic of our climber is that it features a mechanism for automatically adjusting the pressing force applied by the wheels. As shown in Fig.1, a slide screw is turned by the stepping motor, which lifts or lowers the moving part. This in turn results in lifting or lowering of the wheel attached to the moving part; in this way, the pressing force applied to the tether between the two wheels can be adjusted.

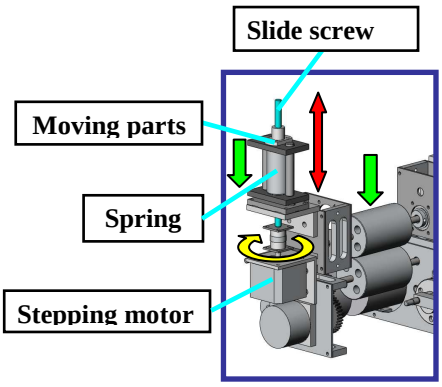

Figure 1

2.3. Manufacture

The main parts used in the climber were prepared from source materials by members of our reseach group. Simple processing was performed with machine tools in our laboratory, and other parts, such as knurling wheels, were manufactured with larger machine tools in the machining center at our university.

2.4. Assembly, Integration & Testing

We developed a laboratory testing apparatus similar to a treadmill which was used to examine the climber's ascent and descent, independent of external factors. On this testing apparatus, we examined the performance of the climber by adjusting the force that the wheels applied to the tether. After this, we ran a tether from the 8th floor of

the school building to the ground (approximately 25m) and experimentally examined the climber's ascent and descent. In the experiment, the climber ascended and descended in a stable manner without slipping.

2.5. Project Management

The members of our team are graduate students in the Egami Laboratory. This research is carried out as part of the student's master's program, and the expenses for manufacturing the climber have been covered by research funds and special funds.

3. Conclusions

Fig.2 shows a photograph of the manufactured climber, whose characteristic feature is its ability to ascend and descend in a stable manner by automatically adjusting the pressing force that the wheels apply to the tether. We hope that our climber utilizing this features will receive a positive evaluation at the European Space Elevator Challenge.

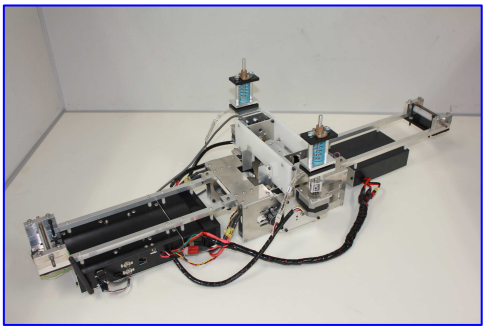

Figure 2

4. Reference

[1]Bradley C. Edwards and Eric A. Westling: "The Space Elevator", Spageo Inc. (2002).

[2] NASA: "Space Elevators: An Advanced Earth-space Infrastructure for the New Millennium", University Press of the Pacific (2006).

[3]Michel Van Pelt:" Space Tethers and Space Elevators", Copernicus Books (2009).