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DEVELOPMENT OF SPACE ELEVATOR CLIMBER APPLIED IN HIGH VACUUM SPACE ENVIRONMENT AND EXTRACTION OF ITS PROBLEMS

Abstract

In the development of the climber mechanism for the space elevator and various control methods that the authors are promoting, the design method has been shown considerably within the range of examination on the ground, and the experiment and verification are being studied.However, there are many problems to be solved in the actual space environment (gravity change, super vacuum, temperature change, debris collision, etc.), and it is necessary to design the climber according to the environment.In particular, climbers that can travel long distances between the geostationary orbit and the earth are in demand, and drive mechanisms and bodies with excellent durability are in demand. In the previous report, we developed a small loop-type climber experimental device and installed it in a vacuum chamber. In the experiment, the operating characteristics, temperature change, durability, etc. of the climber under atmospheric pressure and under low vacuum were compared. As a result, under low vacuum, the effect of air disappears and the operating performance is improved, but problems such as a remarkable temperature rise in the driving part were confirmed. However, the actual degree of vacuum in outer space is even lower, and data under sufficient environmental conditions have not been obtained. In this research, we improved the experimental equipment to enable a high-vacuum environment that is closer to the space environment. (1) Comparing the operating conditions of climbers under high vacuum with environmental data (degree of vacuum, thermal effects, etc.) and their effects on climbers (2) Problems and improvements that arise in climbers when the environment changes continuously from atmospheric pressure to low vacuum to high vacuum As for the content of (1), we examined the effects of heat generated in the chamber on other equipment, and the mechanisms and equipment necessary for climbers under the influence of heat from the outside. As for the content of (2), the experiment is currently underway by changing the environment from low vacuum to high vacuum, and problems that arise (heat, parts, durability of equipment used, etc.) and methods to improve them carried out. In this paper, we report on the operating characteristics, durability, and design method of the developed climber based on the experimental results under three kinds of environments.