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PERFORMANCE VERIFICATION OF SPACE ELEVATOR CLIMBER WITH HYBRID DRIVE ROLLER AND DEVELOPMENT OF SMALL MANNED CLIMBER

Abstract

The climber applied in the space elevator concept requires a special mechanism to move almost vertically between the earth and space. However, it is quite difficult to apply the general elevator mechanism (mechanism to pull up with a rope) used on the ground to outer space. In order for the climber to climb on the tether by his own power, sufficient frictional force is required between the roller and the tether. For the roller drive mechanism, the confronted type and the cross type have been studied, but the operational effects have not been sufficiently studied. The authors focused on the mechanical mechanism and durability that occur when a climber travels a long distance of tens of thousands of kilometers in outer space, and conducted experiments and analyzes of small climbers to investigate operating efficiency and safety. Bottom. The proposed climber is a hybrid mechanism that combines confronted and cross roller drives, and by switching the advantages of each drive type, it is expected that the drive efficiency of the climber will be improved. In this study, the following verifications were carried out for the purpose of developing a hybrid drive climber. (1) Mechanism analysis of each roller system (frictional drive by tether and roller) and confirmation of effectiveness by experiment of hybrid roller system (2) Climber production and operation experiments for developing a small manned climber From the result of (1), the cross type has a wide contact surface and a large frictional force, so it can be used for stable operation when starting and as a brake when stopping. The confronted type is considered to be superior to normal operation at steady state. By using these two methods properly, it became possible to improve the operational performance of the climber. As a result of (2), by applying the hybrid drive mechanism of (1), it became possible to design and manufacture a small manned climber (loading load: 100 kg, two people can ride), and verified its operation performance. Here we were able to establish the basis for a heavier climber design in excess of several tons. Details of the verification results will be introduced in this manuscript and will be presented at IAC-2023.