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DEVELOPMENT AND DRIVING EXPERIMENT OF CLIMBER MECHANISM FOR HEAVY LOAD IN SPACE ELEVATOR

Abstract

In the transportation method of ground port and space station on Space Elevator Plan (SEP), it is very important to grasp and decide the mechanism of driving roller and friction force of the tether for space climber in points of self-weight, transport efficiency and energy consumption. Though it is assumed that the space climber whose weight is 200 tons shuttles in space in the space elevator plan of the Obayashi corporation that some authors propose, neither a concrete design nor development are examined because the climber mechanism relates to the tether material and the energy supply, etc. However, there is little example of developing the climber mechanism made a heavy load object that exceeds 100 kg. In the purpose of this research, we examine the method of designing the climber mechanism that can be gone up and down even by the load of high weight comparatively, and confirm the production and the operation situation. The driving roller of two or more non-confrontation position type were arranged for fibroid tether used by the current state. The pressing power of rollers, the frictional force between tether and roller, the rotation power of roller were calculated, and then the condition that going up and down was able to be controlled was fixed. The load of climber was assumed to be about 200 kg for the amount of the self-respect and the laden weight together. The mechanism model was produced for the climber design. The driving experiment of the climber mechanism was executed by using the experiment equipment where the tether rotated in loop now. The experimental result was reported. On the other hand, the load was about 15 kg of the climber was produced, and it participated in the Space Elevator Challenge 2016 in Japan. This climber was composed of a driving mechanism of the confrontation position type that united four small motors. The climber was able to be moved at standard rising speed 2.0 m/s and descent speed 1.5 m/s. It was possible to go up and down continuously without slipping by giving pressing force enough. In an actual challenge, an excellent result that was three continuous round trips in the time limit by about the high degree 160 m was achieved. In this paper, the outline of the heavy load climber, driving mechanism, control system, the experimental result and the result of Space Elevator Challenge 2016 are explained in details.