Paper ID: 34853
oral

14th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Space Elevator and Tethers (3)

Author: Prof. Fumihiro Inoue
Japan

DYNAMIC BEHAVIOR AND MECHANISM OF DRIVING ROLLER FOR CLIMBER MODEL 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 an increase in the weight, the decrease of the transport efficiency and the loss of energy. So, in the purpose of this research, as the basic technology of the climber, operating a couple of roller placed on the tether was continuously, the dynamic behavior and the frictional force that acted on the roller was investigated. In the experiment, instead of the experiment that the climber moved up and down, the mechanics system was equated moving the tether hang on the counter weight up and down by the driving rollers. In this case, the pushing power to the tether with the couple of rollers was corresponded to the vertical reaction of the frictional force. The result of experiments, in the roller driving mechanism included the brushless motor with reduction gear, four times pushing power to the tether hang on counter weight at least was necessary to keep the vertical position. However, about three times pushing power to counter weight that the tether could move up and down was demanded when the roller was driven. Using these characteristics of the roller driving mechanism, the climber model was designed and manufactured. In contents of the climber, at the position where the roller and tether was engaged, driving motor, pushing mechanism and guide frame of tether was constructed symmetrically in direction of 3 axes and the weight of each parts was balanced. Total weight included the DC battery, driving and control system and cover was about 12 kg. The designed velocity was executed to become from 3.5 m/s to 5.0 m/s. Last year's Space Elevator Challenge 2015 (SPEC 2015) in Japan, the climber was able to achieve the climbing of the 200 m height at first trial. But, the climbing velocity was became very slow because of influence of tether tension and the breakdown of the wireless control was also occurred. In 2016 model of new climber, these problems is solved completely. In this paper, the outline of the climber, driving mechanism, control system is explained in details. And the result of Space Elevator Challenge 2016 held in Japan is reported.