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STUDY ON A SMALL-SCALE AND HIGH-PERFORMANCE SPACE ELEVATOR

Abstract

As a promising future space transportation system, space elevator becomes more and more popular in the aerospace area. However, the magnitude of the elevator scale is one of main factors which limit the development of space elevator. This paper gives a 3000-ton space elevator design scheme, and the GEO payload capacity reaches about 140 tons per week. Firstly, the advantages of space elevator are analyzed compared to traditional launch vehicles, including larger payload capacity, low-cost, more safety and environment-friendly. Secondly, a design method and procedure for the system parameters of the space elevator is developed. To be specific, a method is given to determine the system scale and payload capacity. Meanwhile, the influence of the design parameters on the system scale and capacity are analyzed, including the tether design stress, tether length, number of climbers, and etc. Based on the above analysis and the newest carbon-tube material property parameters, a space elevator is designed, which has a similar scale as a heavy launch vehicle, but the payload capability and cost are much better. And system dynamics of the space elevator is also studied in this paper. This study can be a reference for the future deep study on space elevator.