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Modern Day Space Elevator Transformational Strengths and their Applications (3)

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THE SPACE ELEVATOR APEX ANCHOR : FUNCTIONAL DESIGN CONSIDERATIONS AND PARAMETER EFFECTS

Abstract

The paper includes an analysis of an Earth space elevator system to assess the effect of a number of design parameters on total Tether and Apex Anchor masses. The basic spreadsheet tool previously described in paper IAC-22,D4,3,8,x68299 ("Space Elevator Climber Dynamics Analysis and Climb Frequency Optimisation") led to a revision of the necessary tether strength to cater for the weight of ascending climbers : this 2024 paper now extends this analysis to show the necessary Tether and Apex Anchor masses over a range of tether material working strengths and Apex altitudes, with some discussion of functionality and cost optimisation. The paper also extends work in paper IAC-23,D4,3,11,x76283 ("The Space Elevator Payload Journey Beyond GEO : Climber Concept and Options") to more fully explore the functional design options that might be needed at the Anchor to maintain positional control during climber ascent and spacecraft release. This discussion includes the results of a simple analysis of Anchor motion following a step mass reduction without mitigation, plus a description of mitigating options including thruster and winch systems. The benefits and disadvantages of raising the Apex Anchor to altitudes in excess of 100,000km for greater interplanetary release velocites are described, as is the increased stability control challenge associated with the reduction of the Anchor mass.