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

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TECHNICAL ISSUES AND CURRENT DEVELOPMENT STATUS FOR REALIZING A SPACE ELEVATOR

Abstract

If constructed, the space elevator envisioned to be built on Earth would be the most extended structure in human history. Some of its technical specifications far exceed what is currently technically possible. Therefore, multiple breakthroughs are required for technological development toward realization. First, the required length of the technically most crucial cable is about 100,000 kilometers, but the lengths currently made of carbon nanotubes, a candidate material, are tens of centimeters long. Second, the tensile strength required for cables is about 100 GPa, but the current maximum is only a few GPa. Third, the distance for wireless power supply to climbers (vehicles) that ascend and descend cables is required to be tens of thousands of kilometers, but currently it is only a few hundred meters. Fourth, climbers must climb at least as high as a geostationary orbit (about 36,000 kilometers). However, it has only been demonstrated up to a few kilometers, even with the small-scale model. Other issues include the amount of electricity required to raise and lower the climber, the amount of electricity needed to construct the cable (including the amount of electricity necessary to control the speed of the cable's movement against the Coriolis force and gravity), the effect of solar energy irradiating the cable on the cable temperature, the impact of the cable temperature changes on the cable length and motion, the possibility of cable damage due to lightning strikes, the risk of destruction of the ionosphere, electromotive force and amount of current generated when cable's crossing magnetic field lines and plasma. We will enumerate the essence of these issues and the current development status, provide some prospects for solving them, and formulate a tentative roadmap for technological development.