

20th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Modern Day Space Elevators Entering Development (3)

Author: Dr. John Knapman
International Space Elevator Consortium, United Kingdom, john.knapman@isec.org

ACTIVE CURVATURE CONTROL FOR THE MULTI-STAGE SPACE ELEVATOR

Abstract

The multi-stage space elevator is a proposal for a dynamically supported structure to support part of the tether from the earth's surface, thus reducing the strength requirement of the tether. In Earth's turbulent atmosphere, fast-moving objects called bolts travel in evacuated tubes to minimize friction. The biggest challenge for permanent infrastructure in the atmosphere is dealing with winds, which can be extreme at times. An algorithm called active curvature control has been mathematically derived and verified in simulation to enable the evacuated tubes to bend in such a way that the centrifugal force of the bolts balances the wind. The effect is to transfer the forces to guy wires and ultimately down to the earth's surface. Now that engineering work on a prototype has commenced and some parts of the design have changed or become firmer, a more detailed analysis is needed, taking account of the stiffness of the tubes and the discrete nature of the forces from the electromagnetic control coils compared to the continuous nature of the wind and other forces. This analysis leads to some new insights and design details for the stabilization method.