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Computational methods in the exploration of the classical and statistical mechanics of celestial scale strings: Rotating Space Elevators[1]
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With the advent of ultra-strong materials, the Space Elevator has changed from science fiction to real science. We discuss computational and theoretical methods we developed to explore classical and statistical mechanics of rotating Space Elevators (RSE)[1,2]. An RSE is a loopy string reaching deep into outer space. The floppy RSE loop executes a motion which is nearly a superposition of two rotations: geosynchronous rotation around the Earth, and yet another faster rotational motion of the string which goes on around a line perpendicular to the Earth at its equator. Strikingly, objects sliding along the RSE loop spontaneously oscillate between two turning points, one of which is close to the Earth (starting point) whereas the other one is deeply in the outer space. The RSE concept thus solves a major problem in space elevator science which is how to supply energy to the climbers moving along space elevator strings. The exploration of the dynamics of a floppy string interacting with objects sliding along it has required development of novel finite element algorithms described in this presentation.

[1] L. Golubovic and S. Knudsen, EPL 86, 34001 (2009);
[2] S. Knudsen and L. Golubovic, EPJP 129, 242 (2014).

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