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On the Stability of the Sky-Hook

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The sky-hook, that is a string forming a connection from the surface of the Earth to a satellite in geostationary orbit, which may be used as track for an Earth to space elevator, is an old dream of mankind, originating about 100 years ago in Russia. Besides the question of feasibility from a technological point of view also the question concerning the stability of such a configuration has not yet been completely solved. Under the assumption that a proper material (carbon nanotubes) is available making the connection possible from the technological point of view, we address the question of stability of the radial relative equilibrium of a very long tapered string, which rotates synchronously with the Earth and reaches from the surface of the Earth up into the sky. The solution of the stability problem for different string materials is given by application of the Reduced Energy Momentum Method.

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