15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: CON71

Nonlinear dynamics and control of two tethered satellites: rigid body approach

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Abstract: A mathematical model for a two-dimensional nonlinear two tethered satellites is developed. This system comprises of a long cable (also known as tether) connecting two masses (satellites). Tethered satellites can be used in a variety of space applications such as electrodynamic propulsion, energy harvesting, momentum exchange, artificial gravity, etc. The cable connecting the satellites is approximated by two connecting rod-like rigid bodies. The satellites are modelled as two rigid bodies in the format of cubes. The set of ordinary differential governing equations of motion are obtained using the Lagrange´s equations approach. If the connecting rods are not aligned, it is assumed that the cable is not stretched (i.e. the cable is not under tension). This is an undesirable situation for this type of system. A nonlinear SDRE control is applied on the satellites propulsion system in order to drive the satellites into desired positions so that the rods may be maintained aligned as the whole tethered satellites system realizes manoeuvres in orbit.

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