Modeling of tethered satellite formations using graph theory

Tethered satellite formations have recently gained increasing attention due to future mission proposals. Several different formations have been investigated for their dynamic properties and control schemes have been suggested. Formulating the equations of motion and investigation which geometries could form stable formations in space are cumbersome when done at a case to case basis, and a common framework providing a basic model of the dynamics of tethered satellite formations can therefore be advantageous. This paper suggests the use of graph theoretical quantities to describe a tethered satellite formation and proposes a method to deduce the equations of motion for the attitude dynamics of the formation in a compact form. The use of graph theory and Lagrange mechanics together allows a broad class of formations to be described using the same framework. A method is stated for finding stationary configurations and an upper limit of their number is determined. The method is shown to be valid for general tethered satellite formations that form a tree structure.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, University of California
Contributors: Larsen, M. B., Smith, R. S., Blanke, M.
Pages: 470-479
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Acta Astronautica
Volume: 69
Issue number: 7-8
ISSN (Print): 0094-5765
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.26 SJR 0.758 SNIP 1.49
Web of Science (2017): Impact factor 2.227
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.08 SJR 1.009 SNIP 1.974
Web of Science (2016): Impact factor 1.536
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.49 SJR 1.004 SNIP 1.676
Web of Science (2015): Impact factor 1.095
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.6 SJR 0.908 SNIP 1.699
Web of Science (2014): Impact factor 1.122
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.24 SJR 0.638 SNIP 1.411
Web of Science (2013): Impact factor 0.816
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.97 SJR 0.475 SNIP 1.235
Web of Science (2012): Impact factor 0.701
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.88 SJR 0.479 SNIP 1.22
Web of Science (2011): Impact factor 0.614
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes