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FURNAS 206



**Dr. Eleonora
Botta**

Postdoctoral Researcher,
GlobVision,
Montreal, Canada

DEPLOYMENT AND CAPTURE DYNAMICS OF TETHER-NETS FOR ACTIVE SPACE DEBRIS REMOVAL

ABSTRACT

For containing the growth of space debris, which jeopardizes operation of spacecraft, the active removal of large and massive derelict satellites and launcher upper stages is needed. A promising technology for this endeavour is the use of tether-nets. In this concept, a tether-net is thrown from a chaser spacecraft in the proximity of a target debris towards this target; the net entangles the target or closes around it, and the tether connecting the net to the chaser provides a link to tug debris to its disposal orbit.

This seminar will focus on Botta's research on the deployment and capture dynamics of tether-nets in space, which is based primarily on numerical simulation, with tools expressly developed in MATLAB and in Vortex Dynamics. A simulation tool representative of the complete system will be presented, together with results that provide novel insight into the dynamics of tether-nets in space, such as the identification of safer scenarios for capture. Further insight into the deployment dynamics is obtained through analytical derivations based on work-energy and linear momentum principles, which allow identifying bounds for centroidal velocities during deployment and key parameters leading this dynamics. The effect of modeling choices both on the dynamics and on computational efficiency will also be discussed.

BIO SKETCH

Eleonora Botta is currently a postdoctoral researcher at GlobVision, a software company based in Montreal, where she is working on Space Situational Awareness. She recently obtained a PhD in Mechanical Engineering from McGill University, with a thesis on the dynamics of tether-nets for active space debris removal. She holds a Laurea (B.Eng.) in Aerospace Engineering and a Laurea Magistrale (M.Eng. with thesis) in Space Engineering from Politecnico di Milano, and a Laurea Magistrale (M.Eng. with thesis) in Aerospace Engineering from Politecnico di Torino. She has been awarded multiple scholarships and awards, including the 2015 Amelia Earhart Fellowship and the Mechanical Engineering Doctoral Award (MEDA) at McGill University. She is a reviewer for multiple peer-reviewed journals.



University at Buffalo

Department of Mechanical
and Aerospace Engineering
School of Engineering and Applied Sciences