

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Cooperative Systems (4)

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CONSTELLATION OF FORMATIONS FOR AUTONOMOUS RESIDENT SPACE OBJECT
DETECTION USING STAR TRACKERS

Abstract

The growing number of satellites orbiting Earth requires improvements in Space Situational Awareness (SSA) to guarantee the sustainability of space exploration. The present research explores the autonomous detection of Resident Space Objects (RSO) by utilizing features of Star Tracker technology of typical LEO satellites. We propose a distribution of satellites that fly in formation and are equipped with Star Trackers capable of detecting bright objects, such as RSO, during their star observations for attitude determination. A pair of satellites flying in formation can quickly determine the orbit characteristics of detected objects by utilizing the parallax effect determined by the baseline distance between them. On the other hand, a constellation of these satellite formations improves the coverage of the sky and the statistics of potential RSO orbits accuracy. Simulations are performed to evaluate this satellite distribution for effective RSO detection using as targets the list of the 100+ most luminous objects from the North American Aerospace Defense Command (NORAD) database. Inter-satellite communication and Precise Point Positioning (PPP) services are required to achieve almost real time RSO orbit determination in space. This proposed approach enhances Space Situational Awareness (SSA) capabilities through innovative and collaborative technology to promote the responsible and sustainable exploitation of space resources.

Keywords: Distributed Space Systems, Formation Flying, Resident Space Objects (RSO), Responsible Space Exploration, Space Situational Awareness (SSA), Space Sustainability, Star Trackers.