

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Space-Based Navigation Systems and Services (3)

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COMBINED ATTITUDE-ORBIT APPROACH FOR NAVIGATION AND STATIONKEEPING OF A
PRECISION BEAM FORMING CONSTELLATION

Abstract

Satellite constellations have become a popular choice for sufficing needs ranging from terrestrial navigation (GPS) to communication relay in space (TDRSS). With increasing popularity of small satellite applications, a small satellite constellation would be the most cost efficient solution for smaller applications. A constellation of small satellites can be used for beam forming applications like directional transmission and spatial filtering in satellite communication, high resolution imaging etc. Critical challenge for a beam forming constellation would be precise positioning of each spacecraft in their orbits and attitude based on their position. Traditional ground tracking utilizing Doppler and Ranging for position determination wouldn't render accuracy of order of meters expected for positioning requirements for precision beam forming. The paper lays out simplified relative autonomous navigation process to precisely determine orbit on board as well as relative positions of each spacecraft, layout of a less complex hardware system for navigation (not requiring communication between the spacecrafts), operations encompassed and performance of synchronized attitude orbit data optimized for stationkeeping and attitude control suitably for beam forming in a small satellite constellation around moon. On orbit navigation means independence from ground tracking and lower hardware complexity. Lower hardware complexity offers cost-efficient inclusion of more than one systems to better fulfill navigation and stationkeeping accuracy requirements for a beam forming constellation.