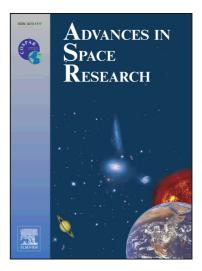
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Gyroscope-Reduced Inertial Navigation System for Flight Vehicle Motion Estimation

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## ACCEPTED MANUSCRIPT

## Gyroscope-Reduced Inertial Navigation System for Flight Vehicle Motion Estimation

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Abstract: In this paper, a novel configuration of strategically distributed accelerometer sensors with the aid of one gyro to infer a flight vehicle's angular motion is presented. The MEMS accelerometer and gyro sensors are integrated to form a gyroscope-reduced inertial measurement unit (GR-IMU). The motivation for gyro aided accelerometers array is to have direct measurements of angular rates, which is an improvement to the traditional gyroscope-free inertial system that employs only direct measurements of specific force. Some technical issues regarding error calibration in accelerometers and gyro in GR-IMU are put forward. The GR-IMU based inertial navigation system can be used to find a complete attitude solution for flight vehicle motion estimation. Results of numerical simulation are given to illustrate the effectiveness of the proposed configuration. The gyroscope-reduced inertial navigation system based on distributed accelerometer sensors can be developed into a cost effective solution for a fast reaction, MEMS based motion capture system. Future work will include the aid from external navigation references (e.g. GPS) to improve long time mission performance.

**Keywords**: Specific force; MEMS gyroscope; Accelerometers configuration; Inertial Navigation System; Rigid body motion

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