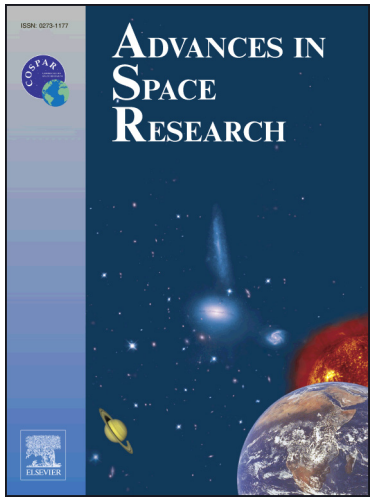

Gyroscope-Reduced Inertial Navigation System for Flight Vehicle Motion Estimation

Xin Wang, Lu Xiao

PII: S0273-1177(16)30497-5
DOI: http://dx.doi.org/10.1016/j.asr.2016.09.001
Reference: JASR 12897

To appear in: *Advances in Space Research*

Received Date: 15 September 2015
Revised Date: 25 July 2016
Accepted Date: 1 September 2016

Please cite this article as: Wang, X., Xiao, L., Gyroscope-Reduced Inertial Navigation System for Flight Vehicle Motion Estimation, *Advances in Space Research* (2016), doi: http://dx.doi.org/10.1016/j.asr.2016.09.001

Gyroscope-Reduced Inertial Navigation System for Flight Vehicle Motion Estimation

Xin Wang[1*], Lu Xiao[2]

1. *School of Astronautics, Northwestern Polytechnical University, Xi'an,710072, P. R. China*
2. *Beijing Institute of Aerospace Systems Engineering, Beijing, 10076 , P. R. China*

***Corresponding author:** Xin Wang, **E-mail**: wangxinfengdz@126.com

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