World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:18, No:04, 2024

Test Bench Development and Functional Analysis of a Reaction Wheel for an Attitude Determination and Control System Prototype

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Abstract : The Attitude Determination and Control System (ADCS) plays a pivotal role in the operation of nanosatellites such as Cubesats, managing orientation and stability during space missions. Within the ADCS, Reaction Wheels (RW) are electromechanical devices responsible for adjusting and maintaining satellite orientation through the application of kinetic moments. This study focuses on the characterization and analysis of a specific Reaction Wheel integrated into an ADCS prototype developed at the National University of San Agust´ın, Arequipa (UNSA). To achieve this, a single-axis Test Bench was constructed, where the reaction wheel consists of a brushless motor and an inertia flywheel driven by an Electronic Speed Controller (ESC). The research encompasses RW characterization, energy consumption evaluation, dynamic modeling, and control. The results have allowed us to ensure the maneuverability of ADCS prototypes while maintaining energy consumption within acceptable limits. The characterization and linearity analysis provides valuable insights for sizing and optimizing future reaction wheel prototypes for nanosatellites. This contributes to the ongoing development of aerospace technology within the scientific community at UNSA.

Keywords : test bench, nanosatellite, control, reaction wheel
Conference Title : ICAAAE 2024 : International Conference on Aeronautical and Aerospace Engineering
Conference Location : Mexico City, Mexico
Conference Dates : April 04-05, 2024