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MODELLING AND SIMULATION OF THE KINEMATIC BEHAVIOUR OF THE DEPLOYMENT MECHANISM OF SOLAR ARRAY FOR A 1-U CUBESAT

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Abstract

Cubesats have transcended mere demonstration systems to sophisticated missions which invariably require the use of deployable solar arrays for more power generation. The kinematics of deployment have considerable influence on the stability and attitude control of a satellite, especially one with such low mass as Cubesats. This work aimed to model and simulate two-wing deployable solar array, with a sun tracking tilt function for a 1-U CubeSat, with emphasis on the deployment mechanism using materials locally available in the country. The design is such that four panels attached to two wings hinged at Y and – Y directions deploy slowly and smoothly at approximately 2 seconds where the vibration decays exponentially and approaches zero. The model of all parts, as well as the computational analysis were done with SOLIDWORKS software. The system was tested for vibration and stability using the seismic mass-spring-and-damper arrangement and the Bond Graph technique was used to conduct kinematic analysis of the mechanism. A 3-D printing was generated and tested to evaluate its operational performance. The simulated results of the model were validated with the prototype outputs with an error of 0.03% in energy supply reliability, about 400% more power generated than the body mounted solar panels of same satellite specification without a significant impact on system strength and Stability.

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