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THE BENEFITS OF SMALL SATELLITES AND SPACE TECHNOLOGY APPLICATIONS FOR
DEVELOPING COUNTRIES: PERU CASE, UNSASAT-1

Abstract

In recent years, the use of small satellites, in many cases known as CubeSat, have been increasing considerably. Mainly because the CubeSat cost-benefit indicator in the mission design in comparison to the conventional satellites. what's more, thanks to the continuous development in the field, the space technology applications of CubeSat are reaching to solve the needs of the society just like the normal satellites does, and more (constellations).

Peru is a country mostly located over the Andes Chain Mountains in South America. Which result in eight altitudinal tiers along the country, giving a vast variety of ecosystems. In consequence, each ecosystem has their own needs and challenges (e.g. the difficult access to populated remote areas). Applications to solve the needs with CubeSat are for example, data acquisition in remote areas, satellite communication, IoT, 5G, etc.

The UNSAsaT-1 small satellite is the first of a 3 satellite constellation, designed by a team of students, professors, and professionals in the Astronomical Aerospace Pedro Paulet Institute (IAPP) of the National University of Saint Agustin of Arequipa, Peru (UNSA), to provide multi-functional services such as remote sensing, internet of things (IoT), and space technology education. The small satellite is based on a 3U CubeSat platform which is expected to have 1 to 2 years of orbit life. The UNSAsaT-1 is designed as a high-cost performance, where an important part of its design is the Attitude Determination and Control System (ADCS). Consider that the small satellite has one 3-axis magnetic torque and four reaction wheels in a pyramid configuration as the actuators. The dynamic modelling, simulation and control techniques have been designed for a rigid body. Different control algorithms are adopted and compared. A quaternion feedback controller (PD), and sliding mode regulator is investigated for the UNSAsaT-1 small satellite. The simulation results of the comparative study and the attitude control design based on the UNSAsaT-1 CubeSat are presented. The other developing CubeSat systems such as the Electric Power System (EPS), Onboard Data Handling (OBDH) system, and communication system for the UnSAT-1 are also presented.