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SYSTEMS ENGINEERING APPLIED TO ORBIT AND ATTITUDE CONTROL SYSTEM (AOCS) OF FORMATION FLYING SATELLITES

Abstract

This paper aims to propose the application of systems engineering for the development of the Attitude and Orbit Control System (AOCS), focused on the propulsion of the Orbit Control System, for a Distributed Spacecraft Mission (DSM) for Formation Flying Satellites (Formation Flying System - FFS). The process must have an integrated development approach that takes into account the lifecycle processes from design, development, testing, operation and services to decommissioning the system. Due to the rapid evolution of the functionalities of small satellite missions, the Attitude and Orbit Control System (AOCS) / Guidance, Navigation and Control (GNC) is becoming increasingly complex. In the case of FFS defined by NASA as "Two or more spacecraft that conduct a mission such that the relative distances and 3D spatial relationships (ie, distances and angles between all spacecraft space) are controlled by direct detection by a spacecraft of at least one other state of the spacecraft", where states are coupled employing control laws. In this way, it involves new GNC functions, which require that each satellite be controlled in attitude and position, for absolute references and in relation to each other. However, the formation flight requires specific sensors and communication for relative navigation and high precision control. Also, it requires highly stable positioning control and the ability to reorient in space. Therefore, it is a great challenge to develop projects that incorporate the AOCS / GNC functionality for such a complex system. The design of AOCS and GNC systems has become a growing need for efficient tools in all domains involved in spaceship design. The application of systems engineering allows proposing a process for the development with high reliability of a DSM of satellites flying in formation.