IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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TECHNICAL SOLUTIONS AND CALCULUS MODEL FOR TESTING VEHICLE WITH HYBRID ROCKET MOTOR

Abstract

The purpose of the paper is to present a technical solution and a calculus model for a testing vehicle which can be used to validate guidance navigation and control (GNC) system for a microlauncher in ascending / descending phase. Technical solution is based on hybrid rocket motors (HRM) capable to ensure by thrust throttling the pitch and yaw command and a reaction control system (RCS) with cold gaze used for roll control. In order to obtained thrust throttling for HRM, we control the oxidiser flow. As support of this approach, we will use some experimental results obtained for thrust control of HRM. For calculus we will develop a nonlinear model with six degrees of freedom, extended with equation for Triger Schmidt nonlinear element used on roll control, end the equations which describe thrust throttling of HRM and the equations which describe RCS functioning. In order to obtain an attitude controller, we develop also a linear model, both models (linear and nonlinear) being similarly with those for the microlauncher, with the purpose to validate GNC for microlauncher. For improve kinematic equations, we will use rotations angles which are a combination between Hamilton quaternion and Euler angles. The results obtained will be flight parameters, control signal and operating parameters for HRM and RCS. We will analyse ascending flight, horizontal flight and descending flight specific for recovery the launcher stages. The conclusions and area of dictions will be focus on possibilities to transpose the results obtained for a testing vehicle with HRM and RCS with cold gas. The novelty of the paper consists in original concept regarding attitude control system using thrust throttling for HRM combined with RCS with cold gaze and the rotation angles used for attitude control during flight phases.