IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Virtual Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (VP)

Author: Mr. Shantanu Trivedi
SRM Institute of Science and Technology, India

Mr. Amit Chowdhary
SRM University, kattankulathur, chennai, INDIA, India
Ms. Vaishnavi Vadlamudi
SRM Institute of Science and Technology, India
Ms. Janhavi Gore
SRM Institute of Science and Technology, India

DESIGN AND FABRICATION OF REACTION CONTROL SYSTEM FOR MODEL ROCKETS

Abstract

Increasing prospects of space travel and transport in the future call for a need of re-usability and inexpensiveness in the rocket or transport systems. Retro-landing rockets are fully and rapidly reusable rockets that drastically reduce the cost of space transport. A control system is required to stabilize and control the rocket with high precision in the final landing phase of the rocket. The control system may also be used to control the attitude in other phases of the flight. Retro-landing rockets often use thrust vectoring or reaction control systems to obtain appropriate attitude control for the rockets to land. Cold gas thrust reaction control systems are an efficient way to obtain attitude control for model rockets. In this paper, we describe the design and fabrication of a cold gas thrust reaction system that is used to control a hybrid propelled model rocket with a negligible margin of error. The primary purpose of this control system is to provide 3 axis control and stability, namely pitch, yaw and roll, to the rocket. A modular reaction control system (RCS) is designed to meet the mass and space constraints of the model rocket. The design of the RCS includes a pressure chamber, piping, pressure regulators, valves and nozzles. The gas used is CO2 because of its easy availability and also doesn't pose issues in its flow through the nozzles. There are 4 nozzles used that are efficiently placed to obtain control in all the necessary directions. The nozzles are placed slightly offset from the diametrically opposite points to do so. The nozzles are also designed in such a way to obtain optimum expansion in order to obtain a higher velocity and flow rates of the gas and hence the reaction force. The valves used are solenoid valves that are operated electromechanically. Electrical impulses are provided by the control system architecture based on the requirements to control the solenoid valves and to permit the flow into the nozzle required. The control system architecture also takes into consideration the latency to provide real time control of the rocket. Each nozzle has a different set of pipes and solenoid valves connecting to the main pressure regulator and pressure chamber. Simulations and preliminary tests of the RCS on the test bed were carried out to finalize the design.