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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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COST-EFFECTIVE SOLUTION FOR THRUST VECTOR CONTROL OF MICROSATELLITE LAUNCH VEHICLES

Abstract

Microsatellite launch vehicle programs have strict requirements to their budget. Therefore a cost-effective and reliable thrust vector control system is mandatory. Additionally, the dimensions of microsatellite launch vehicles are causing smaller moments of inertia compared to large launch vehicles. This means a small vehicle needs a fast thrust vector system to control angular movements.

For the Veículo Lançador de Microssatélites (VLM-1, microsatellite launcher) a thrust vector control system was developed considering low cost and high performance capabilities. VLM-1 is developed in a cooperation between the Deutsches Zentrum für Luft- und Raumfahrt (DLR, Germany) and the Instituto de Aeronáutica e Espaço (IAE, Brazil). The development of such a thrust vector system includes the know-how of different disciplines like structural mechanics, hydraulics, electrical engineering and control theory. Some components are very important concerning the performance of this thrust vector control system. These key components are two hydraulic actuators, a flexible nozzle, a mechanical structure and a controller box. The flexible nozzle is tilted by the two actuators while the actuators are operated by the controller box. Especially the hydraulic actuators are commercial components which are adapted to the needs of fast thrust vectoring. Furthermore, a controller software was developed to increase the performance of the actuators.

The thrust vector control system for VLM-1 combines cost-effectiveness, reliability and high performance in one single system and is also applicable for comparable future rocket systems.