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DELOYMENT CHARACTERISTICS OF A NEW LANDING GEAR FOR LUNAR LANDER

Abstract

This paper introduces a new lunar landing gear, which is composed of primary strut, multi-functional secondary strut, single-function secondary strut and footpad, etc. Energy absorption materials inside the single primary and the two secondary struts provide the capability of absorbing the landing impact energy, and limiting loads induced into the structure. The primary strut and two secondary struts are connected to the probe structure by universal joints, and the two secondary struts and footpads are connected to the primary strut by ball joints. The multi-functional secondary strut is a double-piston structure. It includes outer cylinder, middle cylinder, inner cylinder, pyrotechnic lock-release device, ball-lock and compression spring, etc. During the launch phase, the landing gear is in stowed position. The primary strut is folded at the side of the multi-functional secondary strut, with the inner cylinder contracting and locking to the outer cylinder by the pyrotechnic lock-release device. This will not only meet the requirements of volume profile of the rocket, but also can better bear launch loads. After reaching the orbit, inner cylinder is pushed out relative to middle cylinder by the compression spring, after the lock-release device is fired. At the end of stretch stroke, the ball-lock works and precisely locks the landing gear to its deployed position. The lock-release device has two redundant electric initiators, whenever anyone is ignited the release function can be achieved. The landing gear's stowing, releasing and deploying are all centralized on the multi-function secondary strut. The interfaces between landing gear and probe structure are simplified, so the weight of the system is reduced. And stowing can be achieved in the meantime the landing gear connect the probe structure, without additional workload. Reliability of deployment can be improved greatly with compression spring as the driving source. Whenever the compression spring is broken, the total driving energy will not be reduced obviously. This paper utilizes ADAMS to make a simulation study of deployment characteristics of the landing gear, and carry out deploying tests at simulated "zero gravity". It turns out that the landing gear can deploy reliably, and results from analysis with ADAMS and experiments show nice agreement in both deployment time and velocity.