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Meta-model based Design Optimization of Two-stage Shock Absorption System for Lunar Lander

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Summary

Lunar lander may experience various impact loadings when it makes a landing on the lunar surface. Due to the reason, shock absorption system of lunar lander should be designed to absorb the landing energy of lunar lander efficiently for a successful lunar mission. Shock absorption system should be reliable, and the entire landing energy should be absorbed into the shock absorption system to prevent a critical bouncing or turn-over. One the other hand, to protect the payloads, excessive deceleration should be avoided while absorbing the landing energy.

To design an efficient shock absorption system of lunar lander, which satisfies the aforementioned requirements, two-stage aluminum honeycomb shock absorption system in Fig. 1 is considered and its optimal design both for the cell size and foil thickness is carried out with the weight constraint in this work. In optimal design, meta-model based design optimization methodologies are utilized. Through the optimization, it is observed that landing impact force during the touchdown of lunar lander can be considerably reduced by changing the cell size and foil thickness of honeycomb structure in two-stage shock absorption system.