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LANDING LOADS ANALYSIS OF LUNAR LANDER USING MONTE CARLO METHOD

Abstract

One of the major tasks in the R&D process of lunar lander is to accurately predict the landing loads during the final landing impact event. Considering the uncertainty of landing scenarios, a Monte Carlo simulation is performed to determine the maximum landing loads statistically. Finite element model of lunar lander is constructed using parameterized modeling system, and Abaqus/Explicit is selected as the solver for its excellent nonlinear, transient dynamics capabilities. A series of landing tests are being performed to validate and calibrate nonlinear dynamic finite element models. Subsequent to a numerical model validated by actual test responses, landing simulations will be conducted to compute the landing loads of one hundred scenarios which are randomly selected according to the probability distribution of input parameters. Once the simulations are complete, the statistical behavior of the resultant maximum landing loads is analyzed by Kolmogorov-Smirnov test to justify the assumption of the underlying probability distributions being normal. Finally, the design loads of lunar lander are determined by Three Sigma Rule. It is shown that the landing design loads having low exceedence probability can be determined conservatively and efficiently from a small sample using Monte Carlo Method.