Energy-absorbing characteristics of the re-entry vehicle landing gear crash box

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The article defines energy-absorbing characteristics of the thin-walled energy absorber (crash box) mounted on the advanced landing gear of the aerospace system’s re-entry spacecraft. We consider verifying the parameters of the shell-type finite-element model of small dimension in the software package MSC Nastran SOL700. The work simulates a model problem of elasto-plastic crumpling of square aluminum samples of different thickness. We compare the simulation results with the experimental data. It has been established that the suggested mathematical model provides the tolerance of less than 10 percent for the samples having a width-to-thickness ratio C/s > 30. Based on the model’s verified parameters we have obtained the main energy-absorbing characteristics of the basic square crash box of the landing gear, which was subjected to geometrical modifications in order to improve its damping capabilities. The results obtained can be used for studying the characteristics of the advanced landing gear containing energy-absorbing elements.

Keywords: crash box, energy absorption, MSC Nastran SOL700, landing gear, computational simulation

REFERENCES


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Crash landing occurs due to numerous circumstances. Significant problems and their proportions were illustrated in Fig.1. Moreover, existences of deformable shock absorbers like aluminium, honeycomb and crushable carbon fibres in landing gears are not feasible for high scale mass and crewed landing, as a. Entry begins from entry preparation to hypersonic atmospheric entry, Descent begins from entry to parachute deployment, Landing begins from lander separation to touchdown. The lander remains active in case of soft-landing. 1.2. Hard landing. Because HIAD is emerging as one of the principal technology to faster aerocapture and landing large scale mass and crewed mission on the surface of Mars [15]. Currently NASA’s Langley Research Centre is. The energy absorption for the crashed object is the product of the mean force and the crash length or the area under force displacement curve. The crash stroke of the crash box component is an important parameter for crash component design. During integrated bumper system design, improper placement of the connecting rim will affect the crash length and consequently the energy absorption of the system by blocking the progressive failure of the crash box. The relative position of the crash box and bumper beam rim needs to be optimized in order to get the intended target. Generally, a closed beam profile has better strength and energy-absorbing capacity than open beam profile. The article defines energy-absorbing characteristics of the thin-walled energy absorber (crash box) mounted on the advanced landing gear of the aerospace system’s re-entry spacecraft. We consider verifying the parameters of the shell-type finite-element model of small dimension in the software package MSC Nastran SOL700. The work simulates a model problem of elasto-plastic crumpling of square aluminum samples of different thickness. We compare the simulation results with the experimental data. It has been established that the suggested mathematical model provides the tolerance of less than 10.