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INVESTIGATION OF THE IMPACT CONDITIONS OF A MECHANICAL SHOCK TEST FACILITY

Abstract

A study of the impact conditions of a mechanical shock test facility is conducted. Its purpose is to gain a detailed understanding of the test conditions for space equipment shock tests. At the Institute of Structural Mechanics and Lightweight Design of RWTH Aachen University a mechanical shock test facility is in operation. The facility is based on a ringing plate, which is excited to high-frequency oscillations by the impact of a pendulum hammer in either in-plane (IP) or out-of-plane (OOP) direction. It allows the reproducible introduction of shock loads with specified shock response spectrums (SRS) into a specimen mounted on the ringing plate. The shape of the SRS can be adjusted by variation of the pendulum hammers impact conditions such as velocity, hammer shape, hammer mass, and material combination. These parameters influence the ringing plates response in terms of energy introduction and the excited frequency spectrum. While frequencies up to 10 kHz need to be sufficiently excited to meet test specifications, the excitation of higher frequencies must be limited to avoid overtesting. In this study, the impact event of the hammer on the plate is investigated in detail. Test series with various materials and geometries are conducted to determine the dependence of the impact force pulse on the parameters mentioned before. Therefore, displacements velocities and accelerations during impact are measured. A correlation between geometrical and mechanical properties and the energy introduced into the ringing plate as well as the excited frequency spectrum is established. Furthermore, analytical and numerical approaches are taken to predict the impact behavior. Tests, analytical and numerical methods for modeling the impact event are compared and rated and recommendations for the selection of test parameters for mechanical shock tests are given.