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Title: Fixture Design and Analysis for Multi-axis Mechanical Shock Testing

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Abstract:

Resonant plate shock testing techniques have been used for mechanical shock testing at Sandia for several decades. A multi-axis mechanical shock qualification test is often done by performing three separate uniaxial tests on a resonant plate to simulate one shock event. Multi-axis mechanical shock activities, in which shock specifications are simultaneously met in different directions during a single shock test event performed in the lab do not always repeat and greatly depend on the fixture used during testing. This paper aims to provide an insight on various fixture designs of a concept fixture and angle bracket fixture used for multi-axis shock testing from a modeling and simulation point of view, based on modal frequencies. Initial model validation and testing performed shows substantial disruption of the system under test as the fundamental frequencies drive the response in all three directions. The response also shows that higher order modes are influencing the system, the axial and transverse response are highly coupled, and tunability is difficult to achieve. By varying the material properties, changing thicknesses, adding masses, and moving the location of the fixture on the resonant plate, the response varies significantly. The goal of this work is to identify the parameters that highly influence the modal response of the system when using the angle bracket fixture for a mechanical shock test for the intent of tunability of the system.

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