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# DESIGN OF HYBRID SPACECRAFT SEAT TO ATTENUATE HUMAN SEGMENTAL BIODYNAMIC RESPONSES DURING IMPACT CONDITIONS

**Abstract**

Humans are highly sensitive to whole body vertical vibration under low frequency excitation in seated posture. The purpose of this study is to design a seat structure that provides the least seat-to-head transmissibility responses under vertical vibration and impact conditions experienced during approaches such as Launch, Space shuttle fairing and Landing to ensure the astronauts' safety. The "to-the-body" and "through-the body" biodynamic responses are calculated by developing a FEM model which uses a 11 DOF Lumped parameter model of the human body in the seated position. The seat is developed as a combination of Longitudinal Bonnell springs possessing bilinear stiffness which would absorb the loads and Lateral Helical spring connectors which would help transfer the loads evenly throughout the structure. With the aid of ANSYS® software, a simulation model is achieved to simulate Inertial Acceleration, Random Vibration and Impact loading conditions. The results obtained are compared to a conventional Seat-occupant system for Manned Spacecraft. The predicted Responses from the two models were compared in the terms of Acceleration Responses of Key Body segments and the seat-to-head transmissibility responses. It has been observed that responses predicted by both models exhibited similar trends, but compared to the Conventional design, results of the proposed design gave significantly lower peak values for longer durations. This research can help designers to design spacecraft seat to ensure better safety of astronauts during flight mission.