

19th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Impact-Induced Mission Effects and Risk Assessments (3)

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A COMPARATIVE STUDY OF BALLISTIC PERFORMANCE OF BIO-INSPIRED IMPACT SHIELDS
AGAINST MMOD IMPACT**Abstract**

Micrometeoroid and Orbital Debris (MMOD) is a major threat to spacecrafts orbiting the Earth. Impact shields are employed in spacecrafts to protect them against MMOD impacts as the Debris Avoidance Manoeuvre (DAM) cannot be used because of the huge population and undetectable size range of MMOD. One of the main characteristics of impact shield is its energy absorbing capacity. Recent studies have shown that bio-inspired structures have better energy absorption capacity than conventional structures because of their unique geometries which are a result of evolution over the years.

This paper focuses on comparative study of ballistic performance of various bio-inspired impact shields against MMOD impact using LS-DYNA explicit solver. The proposed impact shield is a sandwich structure consisting of face-sheets and a core. The core structure is made up of simplified geometry inspired from biological structures with core and face sheet material being aluminium alloy 2024-T3. A rigid sphere travelling in hypervelocity regime is modelled as MMOD particle.

The graph of residual velocity versus impact velocity is plotted for each shield and its ballistic limit velocity is determined which is used for comparison of the performance of bio-inspired impact shields. The results are used to study the effect of core geometry on the ballistic performance of the shield. Based on the comparative study, a best bio-inspired core geometry is proposed, which can be used for future development of impact shields for spacecrafts according to the requirements.