

## **HYPERVELOCITY IMPACT (HVI) SIGNAL ANALYSIS**

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### **ABSTRACT**

Hypervelocity is a specific characteristic of the movement of space debris and micrometeoroids. Their high speeds in the space environment leads to major impact effects on a spacecraft surface or protection shield. Depending on the particle speed and diameter, the damage that occurs could lead to perforation of the spacecraft shell; a catastrophic failure of the spacecraft. The impact of these particles is a complex phenomenon that includes secondary ejecta, plasma or phase transformation of material. This paper presents the analysis of signals obtained from four hypervelocity impact tests, analysis done using specific software developed in-house by our research group as a bridge between theoretical research and practical applications of various vibration methods in different areas. This professional tool allowed us to calculate different time-frequency or time-scale transforms from the data file time signal. The application of two methods usually used for analyzing this type of signal, Choi-Williams distribution or Wavelet transform, allowed us to distinguish the characteristics of the two fundamental states of impacted targets; perforation and non-perforation. Based on these results, corroborated with further analysis and experimental tests, a dictionary of materials used for spacecraft protection will be created that includes automatic identification of space debris damage.