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AUTOMATIC OUTLIER DETECTION FOR HYBRID ROCKET STATIC FIRING TESTS

Abstract

A method for automatically detecting anomalous events in the sensor measurements and video recordings of a static firing test was developed. It has been evaluated on a test of the VISERION hybrid rocket engine developed at the German Aerospace Center.

Static firing tests are an important step in designing and qualifying rocket motors as they offer a controlled environment for evaluating the safety and performance of the rocket motor. The temperatures and pressures in different parts of the motor as well as the thrust and videos of the exhaust plume can be recorded to gain insights into the characteristics of the propulsion system. However, manually analysis of this data quickly reaches its limits due to the large amount of raw data. Therefore, in this work an automatic approach for extracting insights from this data is explored. Specifically, a procedure is developed to automatically detect outliers in this data based on the Local Outlier Factor algorithm.

This method is applied to a static firing test of the VISERION hybrid rocket engine. The engine uses a propellant combination of HTPB and hydrogen peroxide and produces a thrust of approximately 11.5 kN over a burn time of 28 s.

In the second static firing, an insufficient composite thermal protection component was used, resulting in delaminations and small pressure increases due to nozzle blockage. The influence on the exhaust plume was recorded by cameras from different angles. The automatic procedure clearly identifies the respective outliers, indicating a promising approach for detailed analyses of engine test data.