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Data Analysis of Hybrid Rocket Fuels Combustion Tests

ALEXANDER RUETTIGERS, German Aerospace Center (DLR), Simulation and Software Technology, ANNA PETRAROLO, MARIO KOBALD, German Aerospace Center (DLR), Institute of Space Propulsion — Clustering techniques were applied to hybrid rocket combustion tests to better understand the complex flow phenomena. Novel techniques such as hybrid rockets that allow for cost reductions of space transport vehicles are of high importance in space flight. However, the combustion process in hybrid rocket engines is still a matter of ongoing research and not fully understood yet. Recently, combustion tests with different paraffin-based fuels have been performed at the German Aerospace Center (DLR). For a better understanding of the experiments, the combustion process has been captured with a high-speed video camera, which leads to a huge amount of images for each test. In order to catch the essential flow structures, the combustion dataset has been analyzed with unsupervised machine learning techniques. In this talk, we present the outcome of the clustering. Using machine learning techniques, valuable insights into the different combustion phases were obtained and a comparison of the quality of the combustion flame in the different tests could be made. In particular, depending on the fuel formulation and oxidizer mass flow, differences in the transients and flame brightness were found.

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