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PAVING THE EUROPEAN RE-ENTRY WAY: THE IXV VEHICLE MODEL IDENTIFICATION
SUBSYSTEM

Abstract

The Intermediate eXperimental Vehicle (IXV) is an ESA re-entry technological platform built to verify in-flight the performance of critical re-entry technologies and to achieve Europe's ambition for a spacecraft to return autonomously from low orbit. The successful flight of the IXV provides the key elements to consolidate the knowledge necessary for the development of future European re-entry systems. The exploitation of in-flight data represents a cornerstone for this flying test bench. In this frame the IXV Vehicle Model Identification subsystem, VMI, represents those steps, techniques and algorithms that shall be applied to the collected data in order to improve the prediction capabilities for future design of re-entry vehicles and specifically to:

- Improve IXV flight dynamics model.
- Validate aerodynamic prediction methods based on Wind Tunnel Tests, WTT, and Computational Fluid Dynamics, CFD.
- Validate the vehicle model identification process and tools.

This paper presents the IXV Vehicle Model Identification Framework that has been designed, developed and validated in order to set-up the off-line estimation approach of the vehicle models based on the in-flight measurements collected during the successful IXV flight and pre-flight vehicle models. The Vehicle Model Identification Framework is made up of the following components:

- Measurement Pre-processing component in charge of preparing input data for the trajectory reconstruction and parameter estimation processes using in-flight measurement, vehicle and environment models.
- Trajectory Reconstruction component in charge of computing the IXV trajectory using the in-flight measurements.
- Parameter Estimation component in charge of deriving the vehicle model parameters for the selected models.
- Model Validation component in charge of confirming the correctness, accuracy, adequacy and applicability of the identified models with their corresponding estimated parameters.