

7th International Conference on Astrodynamics Tools and Techniques (ICATT)



Contribution ID: 53

Type: **Oral presentation at the conference**

ASTOS 9.3 - Multibody Feature for Simulations of Flexible Launcher Dynamics

Wednesday, 7 November 2018 12:30 (30 minutes)

This work presents the new set of equations of motion incorporated in ASTOS release 9.3.

The new implemented feature, based on DCAP multibody software, provides the building blocks to simulate a complete launcher scenario considering vehicle flexibility, sloshing effects, stages separation, engine pressure oscillations and complex aerodynamic loads distribution.

The interaction between those phenomenon and the ascent flight control logic could turn the entire vehicle dynamics unstable. The new functionalities allow ASTOS software to simulate and predict such catastrophic scenarios.

The multibody equations of motion feature let DCAP compute the entire system dynamics while ASTOS provides all the external forces such as aerodynamics, gravity accelerations and actuator output.

Five major features are organically embedded in the new MBS capabilities:

- a linear Euler-Bernoulli beam allows to approximate the flexibility and the frequency content of each launcher structure section;
- a spring-mass system model allows to simulate the propellant sloshing effect in the launcher tanks;
- the transition logic allows to model the separation process during the jettison of exhausted stages by changing the multibody topology;
- separation devices, such as hard-stops and clamp bands, can be employed to reproduce a more realistic scenario during stages disconnections;
- engine pressure oscillations effect can be accounted by providing a disturbance loads in time or frequency domain;

This work details on each of the above mentioned new functionalities, showing user input and results taken from typical example scenarios.

Summary

Primary authors: ROSSI, Valerio (Astos Solution GmbH); SHÄFF, Sven (Astos Solution GmbH); WEIKERT, Sven (Astos Solutions GmbH); WIEGAND, Andreas (Astos Solutions GmbH)

Presenter: WEIKERT, Sven (Astos Solutions GmbH)

Session Classification: Ascent #1

Track Classification: 01: Ascent