Appendix **R**

SYSTEMA-THERMICA Launcher Case Set-up and Thermal Analysis

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Abstract

Thermal analyses of launchers have specific constraints which have been integrated in the up-coming release 4.7 of SYSTEMA-THERMICA. This presentation illustrates through a demonstration the newly integrated features allowing a launcher case set-up.

A new catalogue of volume primitives, required for modeling the launcher, has been added. The software handles the generation of external coating and internal bulk nodes and also automatically switches the activities according to contact detections.

On the mission aspects, launcher trajectories and attitudes are usually defined by discretized data expressed in complex inertial frames (synchronization of rotational frames related to the launcher base position).

Once the geometrical model and mission are set-up, the thermal analysis can start.

The thermal analysis of the previously defined launcher case requires the computation of the conduction into the volume structures as well as radiative exchanges between external coatings, planet Albedo and IR, solar and aero-thermal fluxes.

The presentation focuses on the volume management and on the new aero-thermal flux module which integrates an atmospheric model.

Besides, the new SYSTEMA version 4.7 has new post-processing features: from the generation of mission log data to the comparison of different thermal cases and margins set-up, results based on the launcher case are exploited.





- Volumes
- Mission

Coupled Spacecraft – Launcher Thermal Analysis

- THERMICA, THERMISOL
- Post-Processing

This analysis scenario illustrates new features of 4.6 and 4.7 releases Also applicable to satellite thermal analysis



27th European Space Thermal Analysis Workshop























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 Configurable inputs Definition of groups and collections Time and data filters...







- Using the RCN conductive module
- Advanced Mission Setting
 > Opened / Closed Cavities & Complex Mission scenarios
- Python interface & Batch executions
- Advanced THERMISOL features
 - Using Events, Sub-models, User nodal entities
 - > Parsing nodes & couplings: use of Mortran language & specific fonctions
 - > Tuning the output data of the h5 file







Setting the Kinematics in SYSTEMA

Launcher frame:

- Create a "Free Connection" from the Launch Pad Frame
- Select the kinematic law "Transformations defined in a file"
- Set the rotation sequence to Z-Y'-X"

Then the launcher attitude will be computed using the Azimuth and Elevation expressed in the Launch Pad Frame.