

ABSTRACT

AUTOMATIC CONTROL FOR RE-ENTRY VEHICLE AND RENDEZVOUS AND DOCKING

Current Status and know-how

In the frame of the Expert program an activity on the re-entry vehicle control has been carried on. Expert is a ballistic capsule but has its own Strap-down sensors (IMU) in order to reconstruct the trajectory after the flight. The activity of IMU selection, performances and installation requirements, was performed directly from the aero thermal department.

Working on this project a tool for the flight simulation 6-dof was developed in order to define the trajectory and the capsule performances. The environment utilised to develop the flight simulator is Matlab (Simulink). The tool is capable to simulate a Re-entry Vehicle trajectory considering the environment (gravity and air density) and is ready to take in account also the propulsion and the control subsystem.

In the frame of IBDM demonstration mission know-how on the sensors selection (LIDAR , RGPS IMU) and actuators (Reaction wheels, RCS reaction control system) and their installation was acquired. In order to evaluate the delta-V a tool based on the Hill equations has been implemented.

Further activities preview

An activity to validate the Re-entry tool developed is going on. In order to develop the control subsystem an activity is started that previews the design of a control based on the RCS. The control will be developed based on an optimal controller incorporating a Kalman filter to treat the sensors signals.

Future need

It is foreseen the necessity to develop a control system based on aerodynamics forces like Space Shuttle that can manage the uncertainty in the dynamic characteristics.

For this activity there is a big advantage to work in an integrated team aero-thermal and control due to rapid exchange of the information.

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