Research project meeting summary: Trajectory Module for Launcher MDAO

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Plan : 2 Main steps

The methodology to be followed is divided in the main following steps :

1. First step : 2D Polar Equations of Motion

2. Second step : 3D Cartesian Equations of Motion

Outline of First step : 2D Polar EoM

- Derive equations of motion (EoM) describing 2D planar trajectories in Polar coordinates
- Consider angle of attack to model pitch over maneuver
- Model thrust as constant
- Calculate analytic derivatives of state equations with respect to control parameters as an input for the MDAO
- Objective of the optimization : Minimize time of the trajectory, minimize propellant consumption ?

Resources :

- Framework for Evolutive Launcher optImizatioN (FELIN), ONERA. Available on GitHub
- OpenMDAO : More information about the course in SUPAERO with Dr. Joseph Morlier
- Creation of GitHub account to manage files

Outline of Second step : 3D Cartesian EoM

- Derive EoM describing 3D trajectories in a Cartesian frame. The reason for this is that 3D Polar coordinates have singularities
- Use of Pseudospectral Control methods
- The following events can be included : Jettison of fairings, recovery of first stage
- Lift model can be integrated

Resources :

- Dymos, plug in for OpenMDAO
- Validation of results with Falcon 9 data