Research project meeting summary: Trajectory Module for Launcher MDAO

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Plan:

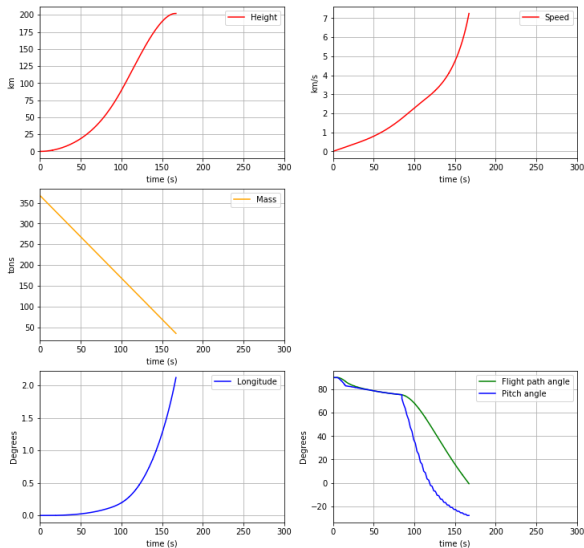1 Review of previous work

2 Key points discussed

3 Future actions

Figure: Optimization in Dymos

- Noisy output for pitch angle during exoatmospheric command.
- Gravity and Cd are constants
- Exponential atmospheric model up to 50 km
- Thrust does not vary with air density
- Minimizing initial mass with final mass fixed at "empty mass"
- Initial guess and launcher parameters based on results obtained with COBYLA
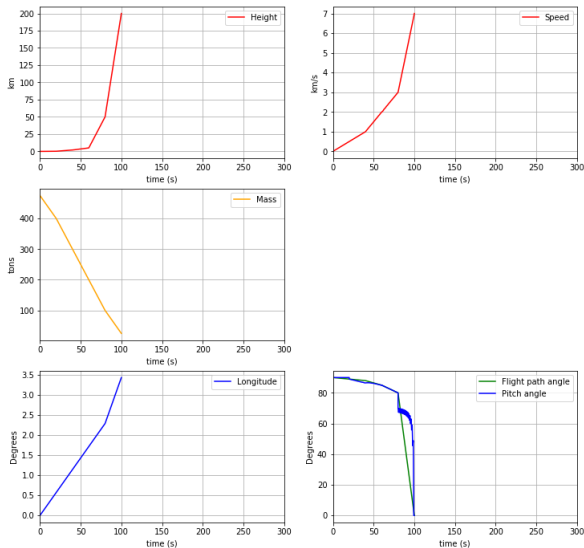
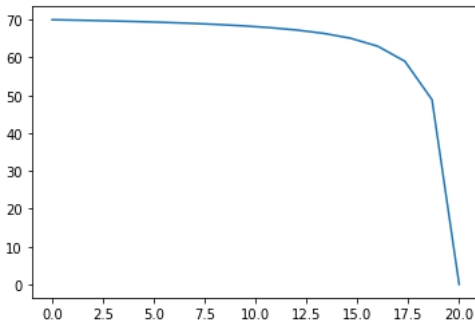Figure: Initial guess - Noise in pitch angle

Figure: Pitch angle during exo-atmospheric command using Debugger

- Noise in pitch angle output during exo-atmospheric command phase. I have to make sure that the results obtained with the "siumulate()" method match those of the optimization. Apparently there is a singularity in the pitch over linear phase, so it would be useful to first make sure that those early phases are being optimized correctly.

- Phase duration management with extraction of last element of phase _time arrays. This is probably an incorrect approach as the last value ofthe jacobian would not match that of the partial of theta w.r.t. phase _duration. I should try again with the set time option "duration _targets"

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- Delta of pitch angle at the beggining of gravity turn with extraction of last element of flight path angle
- Optimization objective: minimize initial mass. it is fine for the moment.
- Implementation of Cd curves using B-spline interpolation. Discuss derivatives. Dr. Balesdent suggest to use "Pchip interpolator" as it is less noisy. remember that NLP solvers demand C^2 continuity.
- Discuss parallelization. Python occupies more than 50% of my CPU , so its probably working fine.
- Discuss scaling (ref, ref0 ...). Add scaling options at every phase

S2-end progress report

- Presentation will be held on the 25/06/20 from 15h00 to 16h00
- Report + 2 page summary due 8 days in advance
- zoom id : 93254635129
- Pr. Lizy-Destrez will share the zoom links in the following days
- Discuss contents and validation of results
- Discuss calendar for S3. Full work on RP in September.
- Dr. Balesdent suggest the following structure:
    1. Bibliography
    2. Reference shooting method with COBYLA
    3. Progress in Dymos

Future actions

- Writing of the second S2 progress report and prepare the presentation.
- Next meeting on 2020/06/22 at 14h00 to discuss about the coming presentation