Research project meeting summary: Trajectory Module for Launcher MDAO

Jorge L. Valderrama [1]
Dr. Annafederica Urbano [2] Dr. Mathieu Balesdent [3] Dr. Loïc Brevault [4]

[1]ISAE-SUPAERO, MSc. in Aerospace Engineering
[2]ISAE-SUPAERO, DCAS [3]ONERA, DTIS [4]ONERA, DTIS

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Plan:

1. Review of previous work
2. Key points discussed
3. Future actions

Review of previous work

I have been working on Dymos trying to perform the optimization procedure in a multi-phase trajectory based on the work that Dr. Brevault shared with me and the examples given in the documentation of Dymos. The objective is to reproduce the same optimization problem that I already solved using the non-gradient based solver COBYLA and to compare it with Dymos' gradient based solvers.

So far I have only manage to minimize time of a one-phase lift-off trajectory. It seems to work fine as the result reaches the lower bound of height that I'm imposing and when using the "Simulate" method the results are similar.

I haven't been able yet to connect two phases. It is taking me longtime to debug in Dymos.

Review of previous work

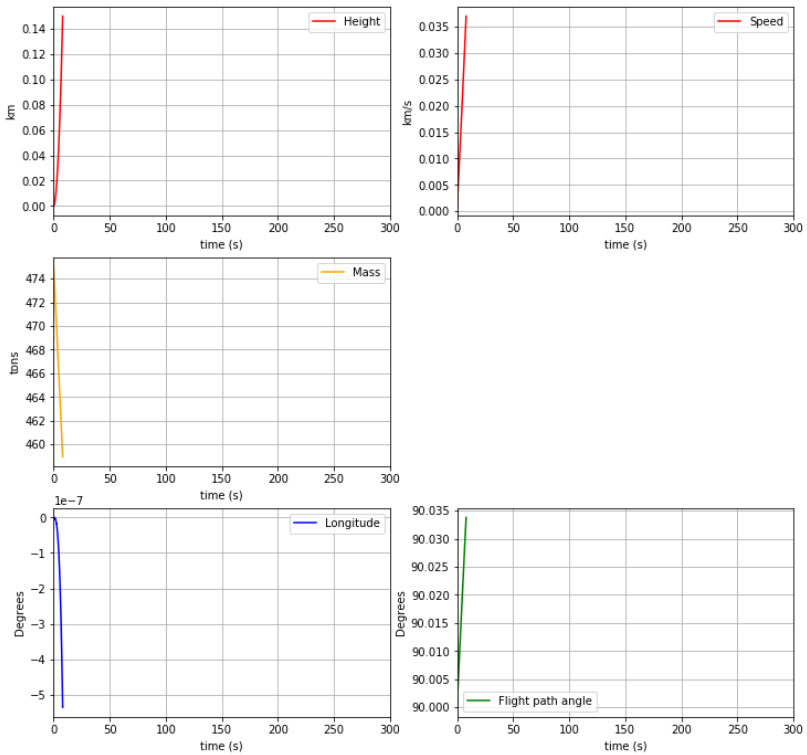

Figure: Optimization result of single lift-off phase using Dymos

Key points discussed

- Strategy to manage guidance parameters:
  As the difference between different phases are the the derivatives involving the guidance law parameters, I was trying to use a class inheritance strategy to implement these changes.
  We discussed that this is not the best strategy and a better approach would be to use a new ”box” or discipline for the guidance model. This takes advantage of the multi-disciplinary nature of openMDAO and may be better suited to the architecture of the software. It also simplifies the analytic derivatives to be provided.

Key points discussed

- Time management strategy:
  The guidance law are defined as function of the elapsed time of each phase and its duration. The duration of the phase is the last element of the elapsed time vector.
  Probably no need to worry about the ”Dirty hack” part of Dr Brevault’s code as Dymos might have improved time management characteristics.
- Use of decorators:
  There are different ways of specifying commands in Dymos, probably the decorators are just and old feature whose function has been replace by the ”add_state” command.
- OpenMDAO documentation may also provided valuable help

Future actions

- Make a table listing the connections to be used in Dymos.
- Keep working on Dymos