



Spacecraft Control Toolbox Version 7.0

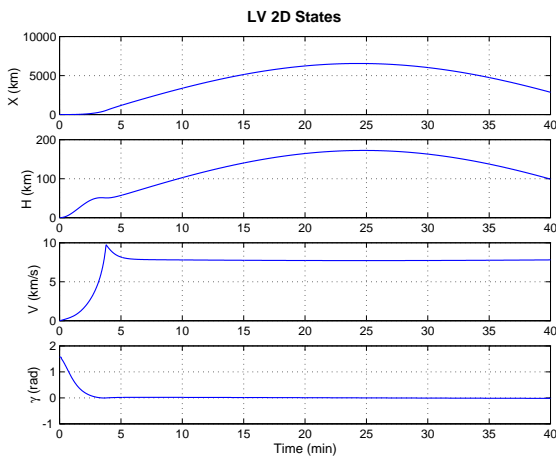
Spacecraft Launch

One of the new capabilities in v7.0 of the Spacecraft Control Toolbox is the ability to simulate launch and reentry. Numerous launch and reentry simulation and analysis tools are included in the update. The following are two examples of launch simulations taken from the new textbook that is included with v7.0 of the toolbox.

Planetary Launch

The toolbox has the capability to simulate launch in both two and three dimensions. Either simulation can handle any number of launch vehicle stages and each stage can have different exhaust velocities and thrust levels. Booster staging is done automatically at stage burnout. Two dimensional simulations are an excellent way of studying large number of launch scenarios. The three dimensional model, which includes models for a rotating spherical planet and a rotating atmosphere, can be used to develop and test guidance laws.

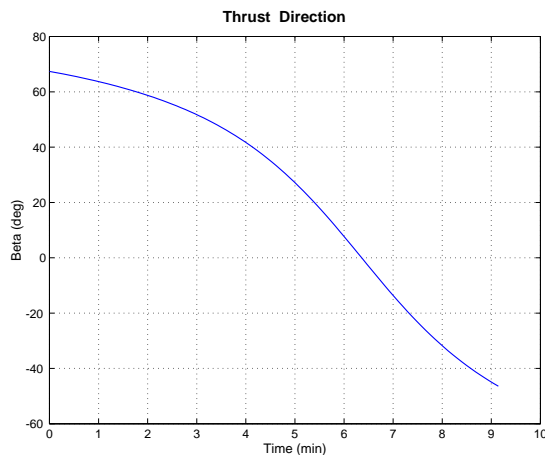
This simulation shows the states from a three dimensional simulation transformed into a plane. As can be seen, the launcher (which is a single stage in this case) goes into a circular orbit in about 4 minutes. The three dimensional simulation is capable of simulating both launch trajectories and orbital motion while the two dimensional model, which uses a flat planet model, is restricted to launch trajectories.



The toolbox also includes analysis functions. For example, the `OptimalPayloadRatio` function, computes the optimal payload ratio for each stage in a multi-stage rocket to maximize the overall payload ratio of the launcher.

Optimal Launch

The following plot shows the thrust direction for an optimal launch from an airless planet like the Moon. The vehicle (such as the Apollo Lunar Module) launches vertically and changes the thrust direction until it reaches a circular orbit. This is not necessarily the globally optimal solution if the desire is to inject into a high circular orbit. Less fuel will be consumed if you use the thrust direction programming to inject into the ascending leg of an elliptical transfer orbit and circularize the orbit at apoapsis.



Upgrading to Version 7.0

If you have purchased or upgraded the Spacecraft Control Toolbox within the last year, you will receive this release for free. Prior customers should contact us for their upgrade price.

For More Information

Contact Princeton Satellite Systems by phone at (609) 275-9606 or by email to info@psatellite.com