



Getting Started with the CubeSat Toolbox

Overview

The CubeSat toolbox is a set of Matlab functions, including a subset of the Spacecraft Control Toolbox, designed to facilitate CubeSat design. The best place to start is to run the example scripts in CubeSat/Demos.

Table 1. Descriptions of the Built-in Demos

Script	Description
AttitudeProfileDemo	Demonstrate the Attitude Profile function. Composes two attitude modes, each with a primary and secondary alignment.
OrbitAndSensorConeAnimation	Demonstrate the playback of multiple orbits and moving sensor cones.
FFSimDemo	Demonstrate the use of FFSim to analyze disturbance effects on the relative motion of close-orbiting spacecraft.
CubeSatSimulation	A power and attitude simulation of a CubeSat. The CubeSat doesn't have a control system but it is easy to add.
TwoSpacecraftOrbitSimulation	A simulation of 2 CubeSats with aerodynamic drag and solar pressure and spherical harmonic gravity model. This gives you all of the disturbances that you will need to do high fidelity orbit simulations.
TwoSpacecraftSimpleOrbitSimulation	The same simulation but with the fewest options.

Most of the functions in the CubeSat toolboxes have built in demos. You need to open the function to read the demo code. If you type the function name in the Matlab window the demo will run.

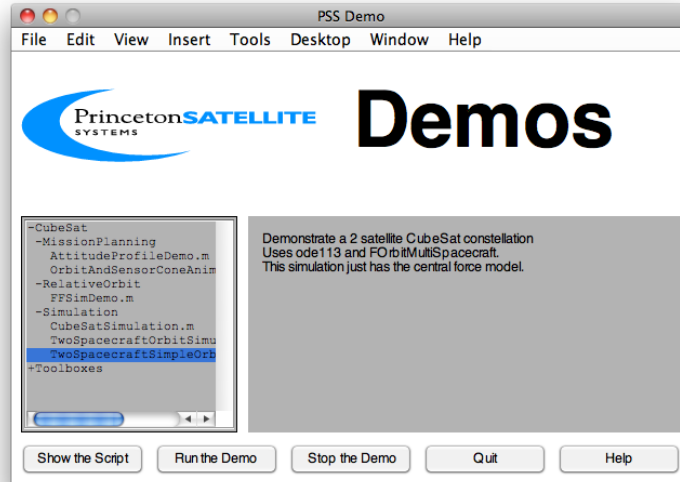
Installation

You should have received or downloaded an archive containing the toolbox. Put the folder extracted from the archive anywhere on your computer. There is no “installer” application to do the copying for you.

All you need to do now is to set the MATLAB path to include the folders in CubeSatToolbox. We recommend using the supplied function `PSSSetPaths.m` instead of MATLAB's path utility. From the MATLAB prompt, `cd` to your CubeSatToolbox folder and then run `PSSSetPaths`. It will add all of the CubeSat Toolbox directories to your Matlab path for the duration of the session, with the option of saving the new path for future sessions.

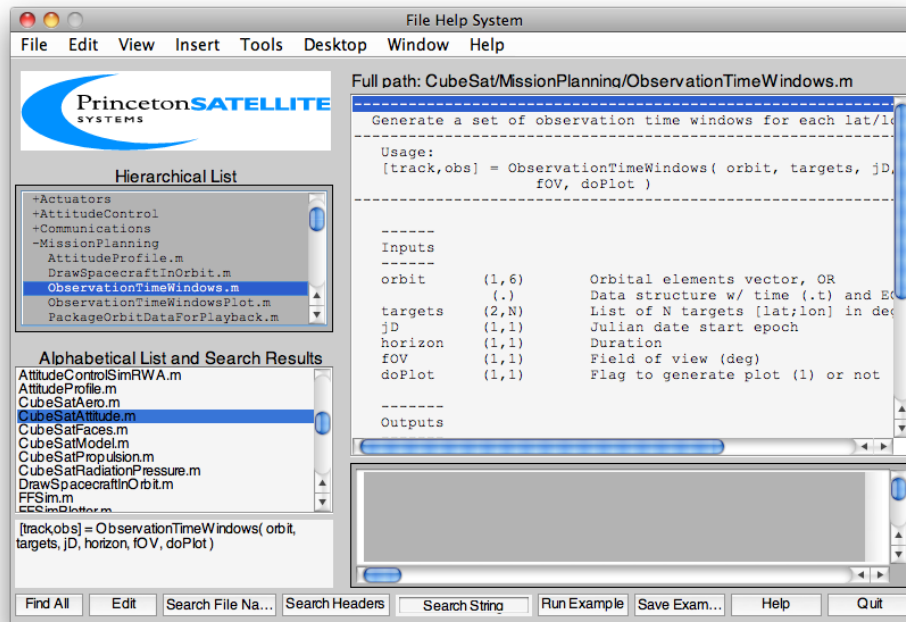
Getting Started

The CubeSat toolbox consists of the CubeSat module and subsets of other modules from the full Spacecraft Control Toolbox. The CubeSat module has a Demos folder and a function `DemoPSS.m`. Never move or remove this function! `DemoPSS.m` looks for other `DemoPSS` functions to determine the location of all demos so it can display them in the demo GUI, shown below.

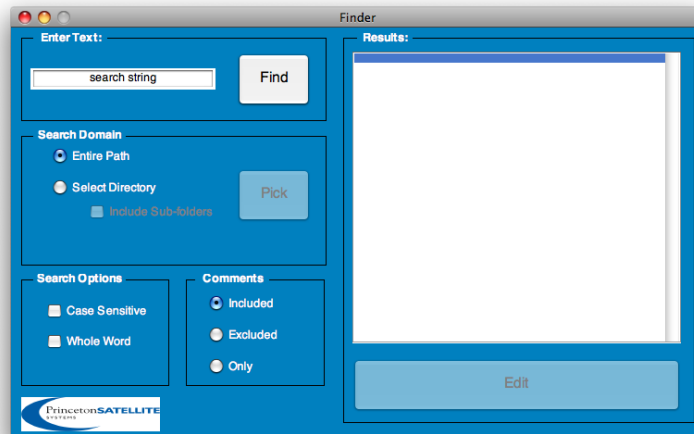


The CubeSat demos are visible in the hierarchical menu to the left. The highest level of this menu shows the folders within the toolbox. You can add your own demo scripts to the demo folders so that they can appear in the display.

The FileHelp function provides a graphical interface to the MATLAB function headers. You can browse the functions by folder to get a quick sense of the capabilities of this toolbox, or search the function names and headers for keywords to find functions for a particular task. Together, FileHelp and DemoPSS provide the best way to get an overview of a PSS Toolbox.

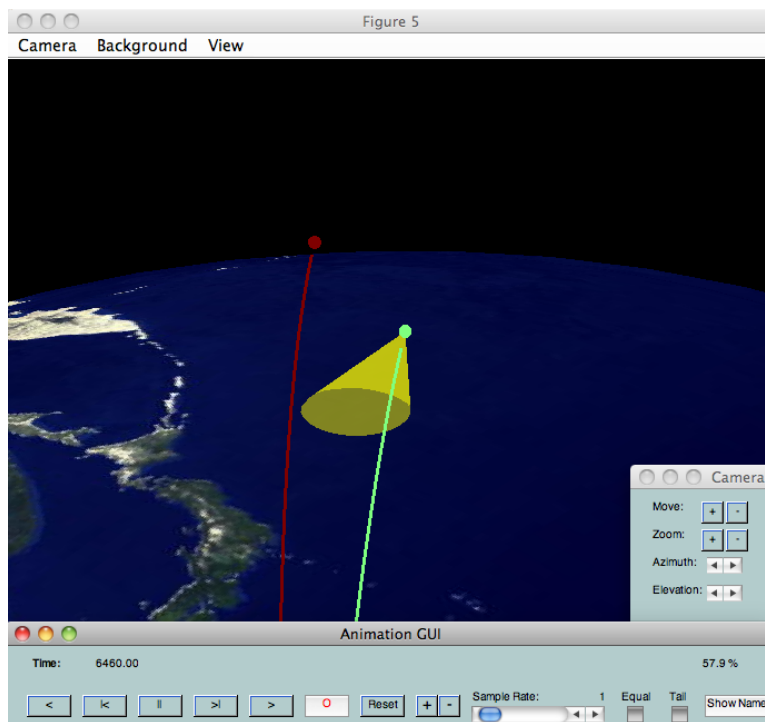


The Finder is another helpful GUI, shown below. Use it to search m-files in your Matlab path, or within specified directories. It is uniquely helpful for searching Matlab functions as you may choose to include or exclude comment lines in your search.



Visualization

The CubeSat Toolbox provides some useful tools to visualize orbits, field of view, lines of sight, and spacecraft orientations. Run the `OrbitAndSensorConeAnimation.m` demo to see how to generate simulated orbits, compute sensor cone geometry, and package the data for playback. The script loads two orbits into the `AnimationGUI`, which provides VCR like controls for playing the simulation forward and backward at different speeds. Set the background color to black and point the camera at a spacecraft, then use the camera controls to move in/out, zoom in/out, and rotate the camera around the spacecraft within a local coordinate frame. The screenshot below shows the 3D animation window, the `AnimationGUI` playback controls, and the camera controls. Press the Record button (with the red circle) to save the frames to the workspace so that they may be exported to an AVI movie.



The CAD model of the spacecraft may also be viewed in its orbit, along with a sensor cone and lines of sight to all of

the visible GPS satellites. Use `DrawSpacecraftInOrbit.m` to generate this view. An example is shown below. The image on the left shows the spacecraft orbit, its sensor cone projected on the Earth, the surrounding GPS satellites, and lines of sight to the visible GPS satellites. The image on the right is a zoomed-in view, where the spacecraft CAD model may be clearly seen.

