



Getting Started with PSS Toolboxes

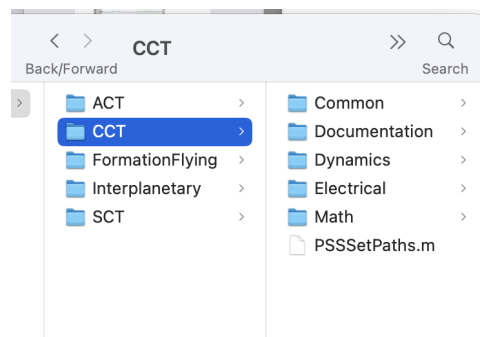
This Getting Started sheet will help you install and run your Aircraft, Spacecraft, or Core Toolbox for MATLAB®. These instructions apply to full purchases or time-limited demos. Thank you from all of us at Princeton Satellite Systems (PSS) for your interest in our products!

Installation

You should have received or downloaded one or more archives containing the software. Create a folder for your new software anywhere on your computer and move the folder(s) extracted from the archives into this folder. There is no “installer” application to do the copying for you. Depending on the products you have purchased, you will receive some subset of these folders, which should be stored together on your computer:

- | | | |
|-------------------|---------------------|------------------------|
| • AC | • LaunchVehicle | • SAAD |
| • AeroUtils | • LunarMissions | • SC |
| • Airships | • Math | • SpacecraftEstimation |
| • Common | • Missions | • SolarSail |
| • CubeSat | • Link | • StraightLine |
| • Electrical | • OpticalNavigation | • Thermal |
| • FormationFlying | • Orbit | • WindTurbine |
| • Imaging | • Plotting | |
| • Interplanetary | • Propulsion | |

For example, if you purchase the Aircraft Control Toolbox, you will download an archive with AC, Airships, AeroUtils, Common, Math and Plotting. If you purchase the Formation Flying Module, your archive would contain only FormationFlying. All PSS toolbox folders should be stored together in one new folder that you create, as shown below.



All you need to do now is to set the MATLAB path to include the toolbox software. We recommend using MATLAB's path utility, or you can run the supplied function `PSSSetPaths` in directories as needed. From the MATLAB prompt, `cd` (change the current directory) to your toolbox folder on your computer and then run `PSSSetPaths`. It will set all of the paths for the duration of the session, with the option of saving the new path for future sessions.

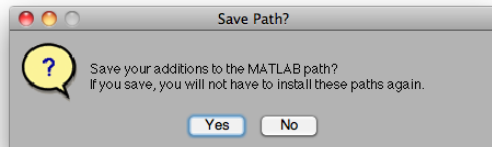
For example,

```
>> cd /Users/me/Desktop/ACT

/Users/me/Desktop/ACT

>> PSSSetPaths
```

You will then see this dialog:



If you choose not to save the path, the output message will look like this:

```
Your path has been updated, but has not been saved.
Type "savepath" to save your changes to the path.

>>
```

Or, if you do choose to save the new path, you will get this message:

```
>> PSSSetPaths

Your path has been updated and saved.

>>
```

You can verify your new path by typing `path` to print the entire path to the command line, or you can see all of your installed products more concisely by typing `ver`. For example, if you have installed the Spacecraft Control Toolbox, when you type `ver` you will see output like this:

```
-----
MATLAB Version: 8.4.0.150421 (R2014b)
...
-----
MATLAB                               Version 8.1           (R2013a)
PSS Toolbox Folder AeroUtils         Version 2015.1
PSS Toolbox Folder Common            Version 2015.1
PSS Toolbox Folder CubeSat           Version 2015.1
PSS Toolbox Folder Electrical        Version 2015.1
PSS Toolbox Folder Imaging           Version 2015.1
PSS Toolbox Folder Link              Version 2015.1
PSS Toolbox Folder Math              Version 2015.1
PSS Toolbox Folder Missions          Version 2015.1
PSS Toolbox Folder Orbit             Version 2015.1
PSS Toolbox Folder Plotting          Version 2015.1
PSS Toolbox Folder Propulsion        Version 2015.1
PSS Toolbox Folder SC                Version 2015.1
PSS Toolbox Folder SCPro             Version 2015.1
PSS Toolbox Folder Sail              Version 2015.1
PSS Toolbox Folder SpacecraftEstimation Version 2015.1
PSS Toolbox Folder Thermal           Version 2015.1
```

Each folder from the list above will be printed separately.

Documentation

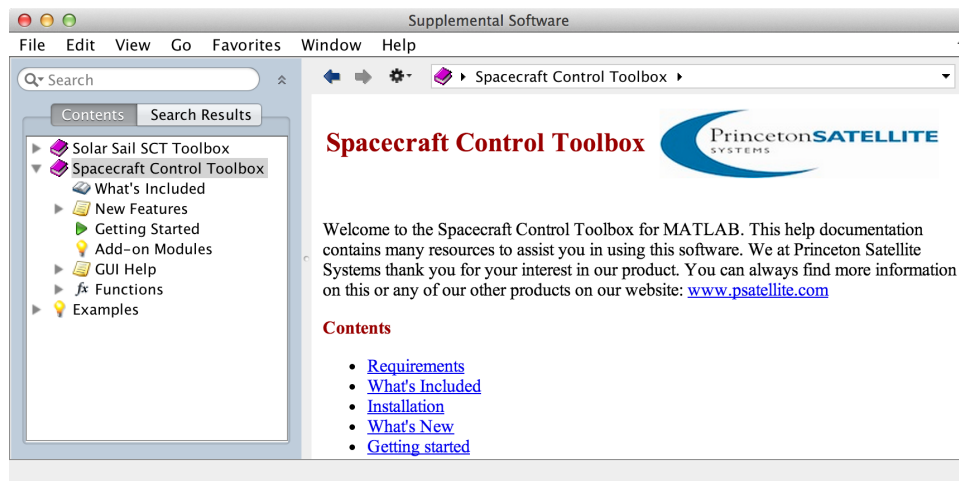
The information in this sheet is also available in the Aircraft Control or Spacecraft Design Toolbox User's Guides. The Guides provide details on more complex toolbox features such as building CAD models and creating your own MATLAB GUI's using PSS plugins, as well as reviewing the MATLAB syntax used commonly in our toolboxes. The guides are downloadable from our website. The website also hosts an online API of all the function and demo headers.

Table 1: Free website documentation

Main Support Page	https://psatellite.com/support/
Online Helpdesk	https://psatellite.freshdesk.com/support/home
Spacecraft API	https://psatellite.github.io/SCTPro/
Aircraft API	https://psatellite.github.io/ACTPro/
Core Control API	https://psatellite.github.io/CoreControl/
Toolbox Demos	https://psatellite.github.io/toolboxes/

The Spacecraft Design Toolbox also comes with a theory guide, Spacecraft Attitude and Orbit Control, that provides technical background on the functionality provided.

Finally, the toolbox provides HTML documentation and published versions of the demos through MATLAB's help browser. In the latest release of MATLAB, you must click on "Supplemental Software" in the help browser main window to view the help for third-party toolboxes such as SCT. Each of your PSS products will be listed as shown.

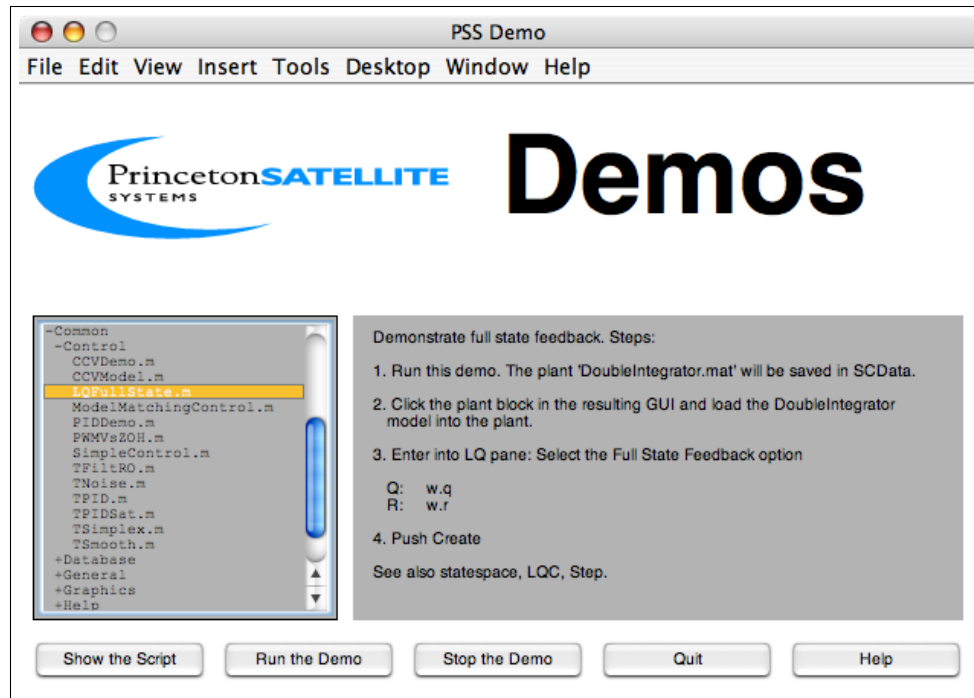


Getting Started

This section introduces three interfaces you can use to get started with the toolbox: DemoPSS, FileHelp, and Finder. The CubeSat Toolbox does not include Finder.

Each toolbox or module has a **Demos** folder and a function `DemoPSS.m`. Never move or remove this function from any of your modules! `DemoPSS.m` looks for other `DemoPSS` functions to determine the location of all demos so it can display them in the demo GUI. Type `DemoPSS` at the command line, as shown, and the GUI appears:

```
>> DemoPSS
```

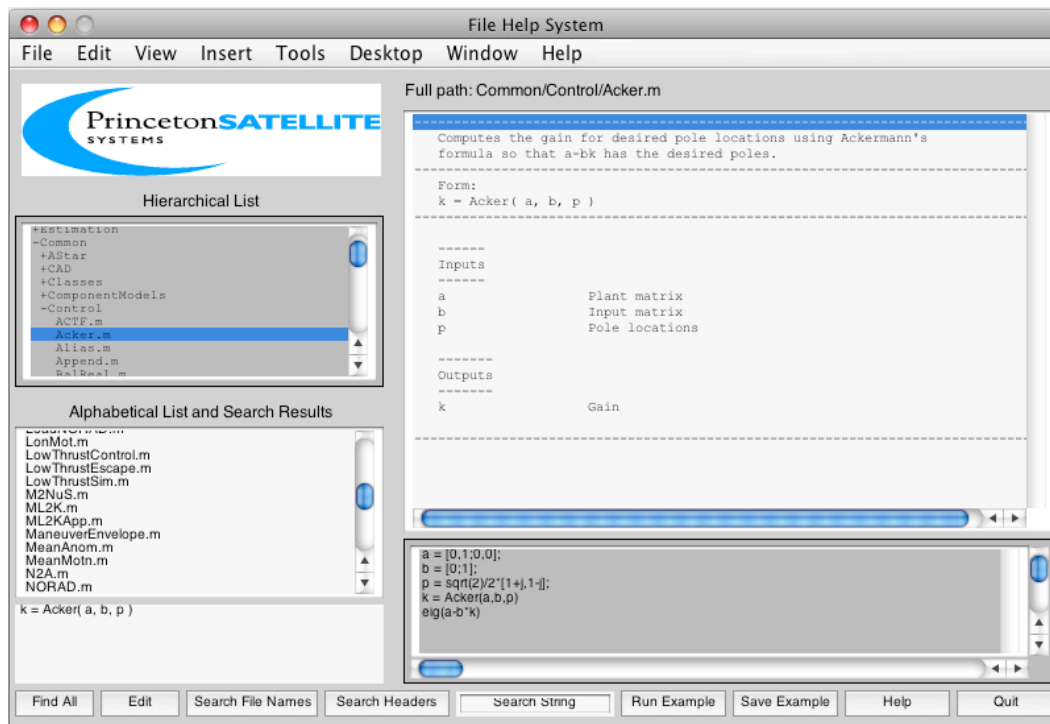


The Common/Control demos are visible in the hierarchical menu to the left. The highest level of this menu shows the folders within the toolbox, for example Common, SC, or AC. You can add your own demo scripts to the demo folders so that they can appear in the display. For each demo, you can run the demo or open the script. Some demos you might want to try first are:

Script	Description	Module Folder
Spacecraft Design Toolbox		
BuildAgileSat	Demonstrates the CAD tools with a very simple spacecraft.	SC/CAD
Attitude3D	Simple numerical simulation using the XYZSat spacecraft CAD model to view the controlled attitude. The dynamics are rigid body attitude (FRB) and Cartesian point mass orbit (FCartOrb).	SC/Attitude
CubeSatWithRWADemo	Implements spacecraft control of a CubeSat with reaction wheels.	SC/Attitude
ThreeAxisControl	Implements and simulates a spacecraft with reaction wheels and thrusters.	SC/Control
InterstellarSim	Interstellar mission simulation. The spacecraft is put into an elliptical orbit with a near-sun perigee. The right-hand-side uses a flag to apply a delta-V at perigee. The delta-V is amplified by the sun's gravity well enabling the spacecraft to quickly leave the solar system.	Orbit/OrbitMechanics
CubeSat Module		
AttitudeProfileDemo	Demonstrate the Attitude Profile function. Composes two attitude modes, each with a primary and secondary alignment.	CubeSat/MissionPlanning
OrbitAndSensor-ConeAnimation	Demonstrate the playback of multiple orbits and moving sensor cones.	CubeSat/MissionPlanning
CubeSatSimulation	A power and attitude simulation of a CubeSat. The CubeSat doesn't have a control system but it is easy to add.	CubeSat/Simulation

Script	Description	Module Folder
Common Demos		
TPIDSat	Demonstrates the effect of integrator windup and how to fix it. Uses PIDMIMO to design the controller and C2DZOH to discretize it.	Common/Control
CCVDemo	Demonstrate eigenvector assignment using a Control Configured Vehicle (CCV) model from Stevens and Lewis (1992). A CCV aircraft is one that includes feedback control as part of its design.	Common/Control
Aircraft Control Toolbox		
CASDesign	Design a simple aircraft control system consisting of a pitch rate tracking system.	AC/ACControl

The FileHelp function provides a graphical interface to the MATLAB function headers of the toolbox. Type FileHelp to open the GUI.

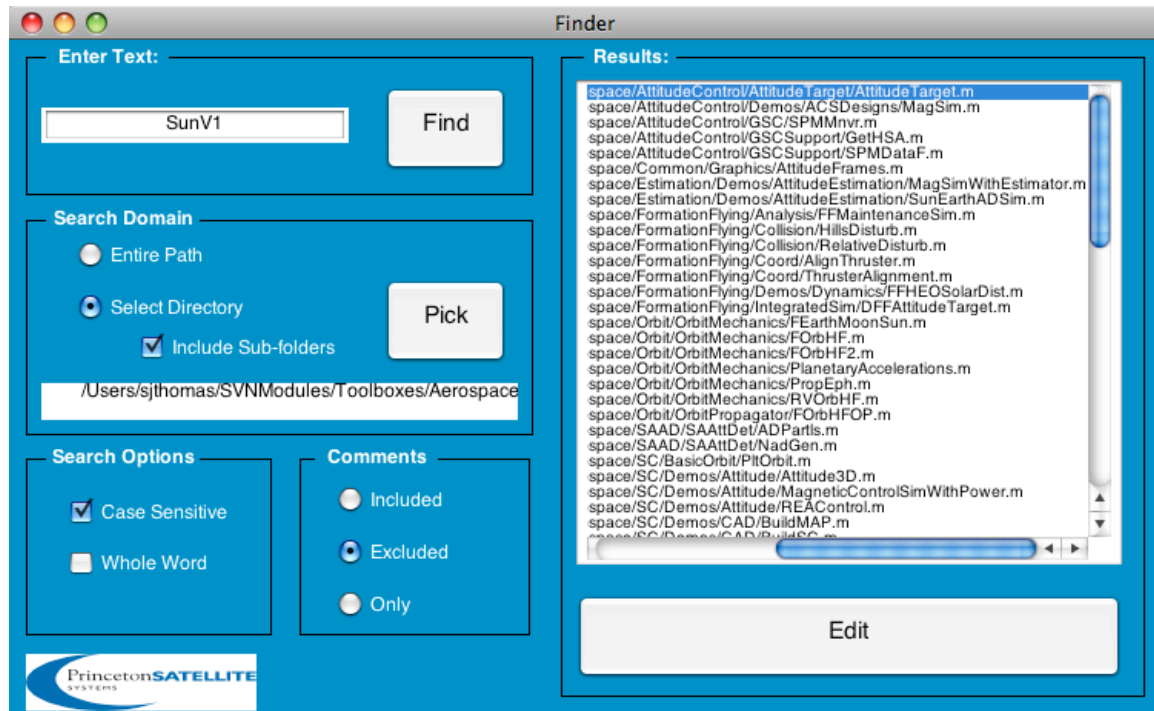


You can peruse the functions by folder to get a quick sense of the product’s capabilities, or search the function names and headers for keywords to find functions for a particular task. The display contains both a hierarchical and an alphabetical display on the left. When you search for functions by replacing the “Search String” text with a keyword and clicking either the Search File Names or Search Headers button, the results will be shown in the alphabetical display window. FileHelp uses a stored mat-file of the headers and searches are very fast. To return to the full display, click the Find All button. From FileHelp, you can open a selected function with the Edit button, and run and save examples using the buttons on the right.

The Finder GUI, shown below, is another handy function for searching for information in the toolbox. (It is not included in the CubeSat Toolbox.) You can search for instances of keywords in the entire body of functions and demos, not just the help comments. You can use this function with any toolboxes, not just your PSS toolboxes, since this actively searches the files every time instead of using a parsed version of the headers the way FileHelp does. Consequently, it is a little slower to use, but you can use it with your own function libraries too.

The Finder function has options for searching the entire path or a selected directory. The subfolders of a higher-level directory can be included or not. The Pick button brings up a file selection dialog where you can navigate to your

desired directory. The search can be case sensitive and you can select whole word matching. You can search on just file help comments, or include or exclude them. For example, you can find all functions and demos that actually use the function PIDMIMO by searching with comments excluded. Once your search results are displayed in the Results window, you can open any file by clicking the Edit button.



Technical Support

We appreciate your feedback! Please let us know if you have any technical questions by writing to info@psatellite.com. Customers may also enter bugs or feature requests via our online helpdesk, <https://psatellite.freshdesk.com/support/home>.