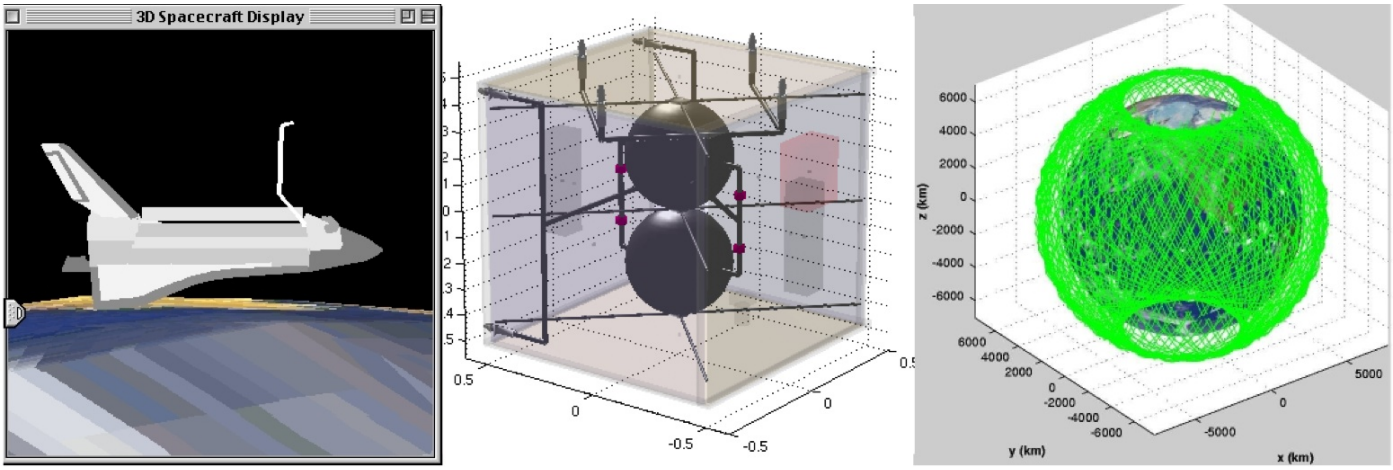
Princeton SATELLITE SYSTEMS

# Spacecraft Control Toolbox Version 7.0




Princeton Satellite Systems is pleased to release Version 7.0 of the Spacecraft Control Toolbox (SCT), for use with MATLAB. The SCT is used worldwide to design, simulate and analyze spacecraft control systems. The toolbox allows you to design and test control systems in a matter of hours, not days or weeks.

You can easily model any kind of spacecraft for use in simulations. You can build spacecraft from components using the built in computer aided design tools making the toolbox an ideal product for doing preliminary designs of spacecraft. You can do disturbance, thermal and power analyses using other functions in the toolbox. Customization is straightforward since full source code is provided.

The SCT has been reorganized so that it consists of the core toolbox and three add-on modules: Formation Flying, Solar Sail, and Spin Axis Attitude Determination. The core toolbox is available in both Professional and Classroom Learning Editions.

## New Functions

The SCT includes attitude dynamics, attitude control, estimation, orbit dynamics and control, thermal, link and propulsion functions.

The following functions are new in Version 7:

- Launch vehicle simulations in 2D and 3D coordinates.
- Reentry vehicle simulations in cartesian and flight path angle coordinates.
- Close maneuvering using A* search algorithms.
- Nuclear propulsion system analysis functions.
- Unscented Kalman filters for state and parameter estimation.
- Ephemeris calculation including astronomical almanac and JPL ephmerides.
- New environmental models including magnetic fields for many planets.
- Distributed planetary albedo function.
- Fault detection including parity space and online approximators.
- Trajectory optimization using indirect methods.
- Plasma propulsion functions.
- Isothermal spacecraft model.
- Thermal radiator and heat shield properties.
- Radar and Ladar link budget analysis.
- New and improved spacecraft control simulations.
- Nonlinear equation solver for multiple equations.
- New functions for optical sensors.
- System failure probability function.
- Object transparency in viewing CAD models.

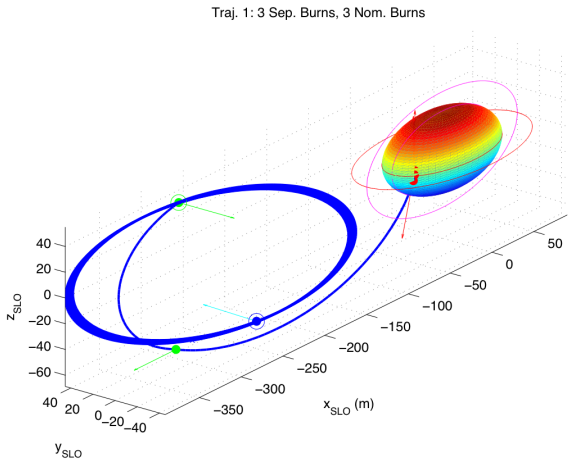
6 Market Street, Suite 926 · Plainsboro, NJ 08536 · Phone: (609) 275-9606
Email: info@psatellite.com · Web: www.psatellite.com

## Formation Flying Module

The Formation Flying module is new to the version 7 release of the Spacecraft Control Toolbox. The module includes numerous maneuver planning and analysis functions that can support formations in both circular and elliptic orbits and in Lagrange point orbits. These functions can be used in conjunction with the attitude, thermal and propulsion functions in the core toolbox to design, analyse and simulation complete spacecraft systems.

The package includes a framework for decentralized formation flying with large numbers of spacecraft developed over the course of two SBIR contracts with NASA Goddard Space Flight Center. The scope of these contracts was to develop a reconfigurable, decentralized framework for autonomous guidance and control in large formations of spacecraft. The outcome of this work was a prototype design for a decentralized formation flying (DFF) control system.

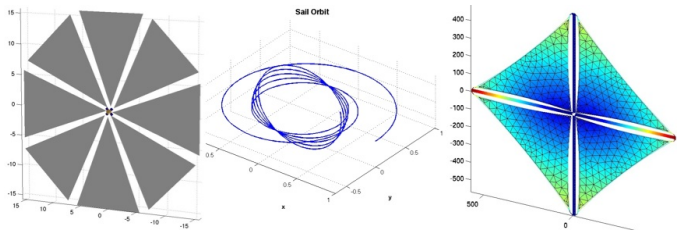
Formation flying is an essential capability for many future missions being planned at NASA, ESA and the DoD. However, it is still a new and developing technology. The Formation Flying Module provides a comprehensive and valuable set of tools for any organization embarking on such a mission. The collection of algorithms, simulations, and design tools offered in the Formation Flying Module is unparalleled in its depth and breadth.




## Solar Sail Module

The Solar Sail Module is new to the version 7 release of the Spacecraft Control Toolbox.

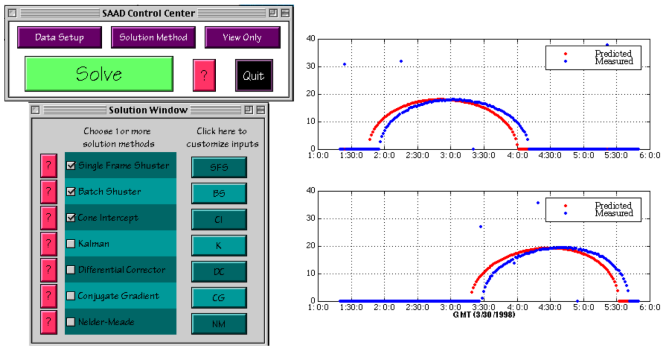
PSS has been developing sail analysis software since 2004 for both NASA's In-Space Propulsion program and the SBIR program. Our high-fidelity disturbance model enables users to simulate complex sail shapes without resorting to analytical approximations. You can study the nonlinear effects of different sail material properties and propellantless actuation schemes. The combination of these special sail CAD and dynamics models with control design tools from the core toolbox provide a complete sail attitude and orbit control analysis solution!




Key features include: propellantless attitude control with vanes, moving mass, and rotating boom, Sail disturbance function with combined optical and thermal force model, locally optimal guidance laws, and design examples such as Cosmos-1, striped square sail, billowed circular sail.

## Spin Axis Module

The spin-axis attitude determination module is a collection of attitude determination algorithms for spin-axis attitude determination using horizon sensors and single-axis sun sensors. It is applicable to missions using either solid apogee kick motors or liquid apogee engines. One or two horizons sensors can be used. The module includes differential corrector, Kalman Filter and nonlinear estimators. It has been used successfully on several commercial satellite launches. Extensive graphics are included.




## 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

6 Market Street, Suite 926 · Plainsboro, NJ 08536 · Phone: (609) 275-9606
Email: info@psatellite.com · Web: www.psatellite.com