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Contact Us:

NASA's Goddard Space Flight Center
Code 102
8800 Greenbelt Road
Greenbelt, MD 20771
› E-mail

General Mission Analysis Tool (GMAT)

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The General Mission Analysis Tool (GMAT) is a space trajectory optimization and mission analysis system developed by NASA and private industry in the spirit of the NASA Vision. GMAT contains new technology and is a testbed for future technology development.

General Mission Analysis Tool (GMAT) Goals

GMAT is an open source, platform independent trajectory optimization and design system designed to model and optimize spacecraft trajectories in flight regimes ranging from low Earth orbit to lunar applications, interplanetary trajectories, and other deep space missions. The system supports constrained and unconstrained trajectory optimization and built-in features make defining cost and constraint functions trivial so analysts can determine how their inclusion or exclusion affects solutions.
The system also contains initial value solvers (propagation) and boundary value solvers and efficiently propagates spacecraft either singly or coupled. GMAT's propagators naturally synchronize the epochs of multiple vehicles and shorten run times by avoiding fixed step integration or interpolation to synchronize epochs of spacecraft.
A user can interact with GMAT using either a graphical user interface (GUI) or script language that has a syntax similar to the MathWorks' MATLAB® system. All of the system elements can be expressed through either interface and users can configure elements in the GUI and then view the corresponding script, or write script and load it into GMAT.
Analysts model space missions in GMAT by first creating resources such as spacecraft, propagators, and optimizers to name a few. These resources can be configured to meet the needs of specific applications and missions. After the resources are configured they are used in the mission sequence to model the motion of spacecraft and simulate events in a mission's time evolution. The mission sequence supports commands such as Nonlinear Constraint, Minimize, Propagate, Function Calls, Inline Math, and Script Events among others.
The system can display trajectories in space, plot parameters against one another, and save parameters to files for later processing. The trajectory and plot capabilities are fully interactive, plotting data as a mission is run and allowing users to zoom into regions of interest. Trajectories and data can be viewed in any coordinate system defined in GMAT, and GMAT allows users to rotate the view and set the focus to any object in the display. The trajectory view can be animated so users can watch the evolution of the trajectory over time.