Scalable Trajectory Design with COTS Software

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ABSTRACT

Leveraging scalable computing architectures for trajectory design applications can provide substantial benefits to the traditional mission design process. Commercial Off-The-Shelf (COTS) software making use of this technology is now available from Analytical Graphics, Inc. (AGI) through the Systems Tool Kit (STK) Server. STK Server allows mission designers to create, manage, and distribute mission models and analysis services over the Web or a network, to be incorporated into any web-service compliant tool. STK Server also provides a scalable platform, for single-server or multiple-server cloud applications.

We explore applications of STK Server and STK Astrogator to a variety of orbit design problems to quantify performance and productivity improvements. Sample trajectories for geocentric, lunar and interplanetary missions are used in these evaluations.

First, we expose complex trajectory design computations as web services, using standard web service interfaces. These well-defined problems have limited inputs and outputs and may be useful to non-experts. Centralized management of all trajectory and mission models allows seamless updating and publishing from the mission designer to this web interface.

Second, we enhance the performance and usability of large-scale, computationally intensive, or repetitive analysis tasks for the mission designer through scalable parallelization. A reference implementation for Monte Carlo analysis uses an orbit covariance matrix to create state perturbations for thousands of propagations, for analysis of potential orbit errors and course correction requirements. Another implementation parallelizes a numerical search algorithm for improved targeting performance for desired reference mission.

Additionally, we identify how this is an enabling technology for some previously impractical trajectory design methods. One example is the use of numerical search algorithms on missions requiring long term propagations, high fidelity force models, or both.