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SOFTWARE DEVELOPMENT FOR GLOBAL TELECOM SATELLITE NETWORK COMPLEX SIMULATIONS

Abstract

Software for simulating satellite flights have existed before, but when trying to use it to approach the problem of simulating global telecommunication satellite networks several problems arise. First problem is that any software designed to simulate a flight of a single satellite (or several satellites) encounters serious difficulties when the object count exceeds several dozen. With a constellation like that, neither memory nor the processing power the program would require are sufficient to perform the task, since it was not foreseen by the developers that it would have to store such vast amounts of data. Even storing ephemeris and satellite properties becomes a problem, making the modelling scenario require up to several gigabytes of disk space, let alone the access data, bitrates and angles in communication links. The last factor, but not least, is those software products' tremendous cost. Yaliny is currently developing its own simulation software for the company's prospective telecom satellite constellation. The key difference of this complex is that it is developed specifically for telecommunication satellite constellations and takes into account all the problems mentioned. Also, a technique is used in this software to simulate possible failures, which can help to adjust system architecture to improve its reliability. The software complex consists of four major parts, or modules, operating more or less independently. The results from one module may be imported into other ones as raw data. First module is a classic orbit propagator with different propagation techniques and options for perturbations. The second module simulates the data traffic, subscriber activity on Earth, intersatellite communications etc. This module's purpose is to calculate link margins and hardware loads. Simulation results are then analyzed with respect to the overall capacity of the system. This analysis provides the source data for power consumption and thermal analysis. The third module is about power consumption: analyzing satellite's relative position to the Sun and the Earth it calculates the power budget, tracks the dynamic of accumulator charges and discharges and shuts the payload down to minimize the consumption if the battery is about to discharge to a dangerous level. The fourth module simulates all the operations processed through the onboard computer: resource distribution, attitude determination, satellite stabilization and control, station-keeping. It produces various output data for every subsystem of the satellite – attitude profiles, power consumption, reaction wheels load, etc. A convenient interface then puts all the results together for visualization.