



SAT-LAB: A MATLAB Graphical User Interface for simulating and visualizing Keplerian satellite orbits

Dimitrios Piretzidis and Michael G. Sideris

Department of Geomatics Engineering, The University of Calgary, Calgary, Canada (dimitrios.piretzidis@ucalgary.ca)

SAT-LAB is a MATLAB-based Graphical User Interface (GUI), developed for simulating and visualizing satellite orbits. The primary purpose of SAT-LAB is to provide software with a user-friendly interface that can be used for both academic and scientific purposes. For the simulation of satellite orbits, a simple Keplerian propagator is used. The user can select the six Keplerian elements, and the simulation and visualization of the satellite orbit is performed simultaneously, in real time. The satellite orbit and the state vector, i.e. satellite position and velocity, at each epoch is given in the Inertial Reference Frame (IRF) and the Earth-Fixed Reference Frame (EFRF). For the EFRF, both the 3D Cartesian coordinates and the ground tracks of the orbit are provided. Other visualization options include selection of the appearance of the Earth's coastline and topography/bathymetry, the satellite orbit, position, velocity and radial distance, and the IRF and EFRF axes.

SAT-LAB is also capable of predicting and visualizing orbits of operational satellites. The software provides the ability to download orbital elements and other information of operational satellites in the form of Two-Line Element sets. The user can choose among 41 satellite categories, including geodetic, communications, navigation, and weather satellites, as well as space debris from past satellite missions or collisions. Real-time tracking of the position of operational satellites is also available.

All the capabilities of SAT-LAB software are demonstrated by providing simulation examples of geostationary, highly elliptical and near polar orbits. Also, visualization examples of operational satellite orbits, such as GNSS and LEO satellites, are given.