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Scilab and Xcos for VLEO satellites modelling

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Very Low Earth Orbits are orbits in altitudes lower than 450 km. The interaction between the atmosphere particles and the surfaces of the spacecraft is responsible for the aerodynamic torques and forces. Simulating several aspects of the performance of a satellite flying in VLEO is very important to make decisions about the design of the spacecraft and the mission.

In this paper we present the work carried out in Scilab 6.01 in order to build a Xcos toolbox to be used for simulations in VLEO. We consider the environment perturbation torques action on the satellite in these orbits. Thus, we integrate in Xcos several blocks with updated models for the perturbations, not available in other toolboxes, such as Drag Temperature Model DTM2013 to simulate the atmosphere density or Horizontal Wind Model HWM14 to consider the effects of the wind on the spacecraft. We implemented a panel method to simplify the calculation of the aerodynamic torques and integrate them in the loop of the simulation. We calculate the orbit and the acting torques, simulating different maneuvers and geometries of the satellite.

We analyze the advantages of using a panel method and we compare the results with results from other papers or methods, such as Direct Simulation Monte Carlo.

The implemented blocks will be released as a public toolbox to be used by the community.