Dynamic Model Development For Interplanetary Navigation

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The dynamic model for interplanetary navigation has been developed. The Cowell method of special perturbation theories was employed to develop an interplanetary trajectory propagator including the perturbations due to geopotential, the Earth's dynamic polar motion, the gravity of the Sun, the Moon and the other planets in the solar system, the relativistic effect of the Sun, solar radiation pressure, and atmospheric drag. The equations of motion in dynamic model were numerically integrated using Adams-Cowell 11th order predictor-corrector or Runge-Kutta 7-8th method. To compare the influences of each perturbation, trajectory propagation was performed using initial transfer orbit elements of the Mars Express mission launched in 2003. To investigate the applicability of dynamic model developed, the minimum distance from the spacecraft to the Mars at arrival time was tested, because the position of the spacecraft at arrival time must be within the SOI(Sphere of Influence) of the Mars. The interplanetary navigation tool developed in this study yields the spacecraft arriving distance within Mars SOI, hence, the spacecraft could arrive at the target planet. The results obtained are verified using the AGI Satellite Tool Kit. It is concluded that the program developed is suitable for supporting interplanetary spacecraft mission.