# Orbit Propagation Software for Mars Orbiting Spacecraft

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Orbit propagation software for the Mars orbiting spacecraft has been developed and verified, in preparations for the future Korean Mars missions. When a spacecraft is located in the vicinity of Mars, it is convenient to utilize Mars centered coordinate systems. Mars true equator is used as the reference plane and Mars International Astronomical Union (IAU) vector as the reference axis for Mars Centered Inertial (MCI) coordinate system. Mars prime meridian is also used as the reference axis to define Mars Centered Fixed (MCF) coordinate system. Coordinate corrections to the Mars centered system have been made to adjust the errors caused by Mars precession and nutation effects. After spacecraft enters Sphere of Influence (SOI) of the Mars, spacecraft experiences various perturbation effects as it approaches to Mars. Every possible perturbation effects are considered during integrations of spacecraft state vectors, including solar radiation pressure, Mars gravity field, Mars atmospheric drag, gravitational effects of Mars moon's (Phobos and Deimos), and nine solar planets with the Sun. To compute exact locations of other planets, JPL's DE405 ephemerides are used. Phobos and Deimos's ephemeris are computed using analytical method because their informations are not released with DE405. The Mars50c gravity field model and the MARS-GRAM 2001 model are used to compute perturbation effects due to Mars gravity field and Mars atmospheric drag respectively. Mars Global Surveyor's mapping orbital data are used to verify the developed propagator performances. One Martin day propagation (12 orbital periods) show about maximum ±5 meter errors, in every position state components, when compared to Astrogator propagation results from Satellite Tool Kit.