# Orbit Determination using Geomagnetic Field via the Unscented Kalman Filter

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Autonomous orbit determination of spacecraft using only magnetometers has been studied in several literatures and also verified using real flight data. The determined spacecraft position errors range from 4 km to hundreds of kilometers achieved by only the magnetometer data, and these coarse accuracies are still obstacles to more practical applications of the magnetometer-based orbit determination method. The main purpose of the current study is to improve the real-time position accuracy of the magnetometer-based orbit determination by adopting a new estimation technique - the Unscented Kalman Filter (UKF) and by modifying the dynamic model more properly to the geomagnetic field measurement. The developed algorithm is tested through the extensive numerical simulations and is also tested using actual flight data of Magnetic Field Satellite (MAGSAT). The results obtained from MAGSAT data demonstrate that the achieved position accuracy of spacecraft can be reach about 2 km using only geomagnetic field measurements. This advancement makes the magnetometer more robust and reliable sensor for the real-time orbit determination system of smaller explorer - the required position accuracies are coarse or the back up system of larger explorer.