# Real-time attitude-independent three-axis magnetometer calibration

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Abstract: New real-time approaches for three-axis magnetometer sensor calibration are derived. These approaches rely on a conversion of the magnetometer-body and geomagnetic-reference vectors into an attitude-independent observation by using scalar checking. The goal of the full calibration problem involves the determination of the magnetometer bias vector, scale factors, and nonorthogonality corrections. Although the actual solution to this full calibration problem involves the minimization of a quartic loss function, the problem can be converted into a quadratic loss function by a centering approximation. This leads to a simple batch linear least-squares solution, which is easily converted into a sequential algorithm that can be executed in real time. Alternative real-time algorithms are also developed based on both the extended Kalman filter and Unscented filter. With these real-time algorithms, a full magnetometer calibration can now be performed on-orbit during typical spacecraft mission-mode operations. The algorithms are tested using both simulated data of an Earth-pointing spacecraft and actual data from the Transition Region and Coronal Explorer.

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