REAL-TIME MAGNETIC ANOMALY DETECTION USING MOBILE AUTONOMOUS PLATFORMS

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Advances in autonomous platforms are revolutionizing the way we collect geophysical data. By using autonomous platforms, we are able to collect enormous amounts of data in a fraction of the time, process said data quickly using easily accessible computing technologies, and interpret the results on the fly. Prouty and Tchernychev [1] demonstrated real-time localization of magnetic anomalies with a static 3-dimensional array of prototype miniature scalar magnetometers. Small, light-weight, low-power magnetometers are now commercially available and enable mobile deployment of such arrays using autonomous platforms. This allows for enormous flexibility in system configurations, providing optimal anomaly detection and localization performance for a given target class.

Here, we investigate the system performance of few such configurations in localizing magnetic anomalies of different strengths. The anomalies are placed at a few closest-point-of-approach (CPA) distances and with varying orientations relative to the ambient magnetic field. Specifically, we implement gradient-based inversion techniques that synthesize along-tract gradient from platform motion and calculate vertical gradient using upward continuation. We examine the effects of variable platform velocity on localization performance. Finally, we briefly touch upon the feasibility of using on-board Inertial Measurement Unit (IMU) to predict and correct for the sensor array velocity in the localization algorithm.

The real-time localization information can potentially significantly reduce mobilization costs and improve efficiencies in a number of geophysical applications including Unexploded Ordnance (UXO) remediation efforts and pipe-tracking surveys.

[1] Real-time threat detection using magnetometer arrays, M.D. Prouty and M. Tchernychev, SPIE Defense + Security, 2016.