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LARGE-SCALE KALMAN FILTERING USING THE LIMITED MEMORY BFGS METHOD*

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Abstract. The standard formulations of the Kalman filter (KF) and extended Kalman filter (EKF) require the storage and multiplication of matrices of size $n \times n$, where n is the size of the state space, and the inversion of matrices of size $m \times m$, where m is the size of the observation space. Thus when both m and n are large, implementation issues arise. In this paper, we advocate the use of the limited memory BFGS method (LBFGS) to address these issues. A detailed description of how to use LBFGS within both the KF and EKF methods is given. The methodology is then tested on two examples: the first is large-scale and linear, and the second is small scale and nonlinear. Our results indicate that the resulting methods, which we will denote LBFGS-KF and LBFGS-EKF, yield results that are comparable with those obtained using KF and EKF, respectively, and can be used on much larger scale problems.

Key words. Kalman filter, Bayesian estimation, large-scale optimization

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