

# Self-Starting Multivariate Control Charts for Location and Scale

Edgard M. Maboudou  
Department of Statistics  
University of Central Florida,  
Orlando, FL 32816

September 17, 2009

## Abstract

Multivariate control charts are very effective when monitoring several correlated characteristics. Proper process control consists of monitoring both mean and variability. In multivariate settings, the multivariate exponentially weighted moving average (MEWMA) is ideal to monitor the mean vector. Similarly, the recently-proposed multivariate exponentially weighted moving covariance matrix (MEWMC) detects changes in the covariance matrix. Using these two charts simultaneously provides a way to satisfy Shewart's dictum of always monitoring both location and variability. However, both charts were established under the assumption that the parameters are known a priori. In practice, the process parameters are commonly unknown so that the assumption of known parameters does not hold. The usual approach to this difficulty is to use estimated values from a Phase I study to calibrate the charts. However, using estimates in place of known parameters adds a random element to the run length distribution, and harms chart performance. This is now known to be true even for large calibration samples. A different approach is to use self-starting methods, which correctly studentize the incoming stream of process readings, and can provide exact control right from startup.

**Key Words:** Recursive residual; regression adjustment; Average run length (ARL); Multistandardization; Cholesky decomposition.