Multivariate Standardized Time Series for Steady-State Simulation Output Analysis

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The theory of standardized time series, initially proposed to estimate a single steady-state mean from the output of a simulation, is extended to the case where more than one steady-state mean is to be estimated simultaneously. Under mild assumptions on the stochastic process representing the output of the simulation, namely a functional central limit theorem, we obtain asymptotically valid confidence regions for a (multivariate) steady-state mean based on multivariate standardized time series. We provide examples of multivariate standardized time series, including the multivariate versions of the batch means method and Schruben's standardized sum process. Large-sample properties of confidence regions obtained from multivariate standardized time series are discussed. We show that, as in the univariate case, the asymptotic expected volume of confidence regions produced by standardized time series procedures is larger than that obtained from a consistent estimation procedure. We present and discuss experimental results that illustrate our theory.