Two topics in parametric integration applied to stochastic simulation in industrial engineering

Jeremy Staum, Northwestern University

In stochastic simulation, it is natural to use the Monte Carlo method to approximate an integral that gives the expected performance of the simulated system. A parametric integration problem arises because we want to approximate the function that maps simulation model parameters to system performance. We show that a multi-level Monte Carlo algorithm greatly reduces the computation cost required to achieve a target error in parametric integration example problems drawn from industrial engineering. The second topic is an investigation of the function approximation method to use in such problems. We consider kriging with generalized integrated Brownian field (GIBF). This Gaussian random field (GRF) is closely related to a Sobolev space that is a reproducing kernel Hilbert space, and to the folded Wiener sheet measure that has been used in average-case analysis in IBC. The approximation error in example problems was reduced, sometimes greatly, by using GIBF instead of GRFs used commonly in kriging.