Stanford University
Department of Statistics

Departmental Seminar

4:30pm, Tuesday, February 13, 2018
Sloan Mathematics Center Room 380Y

Refreshments served at 4pm in Sequoia Lounge.

Speaker: Art B. Owen
Department of Statistics,
Stanford University

Title: Importance sampling the union of rare events with an application to power systems analysis

Abstract:

We want to estimate the probability μ of a union of J rare events. The method uses n samples, each of which picks one of the rare events at random, samples conditionally on that rare event happening and counts the total number of rare events that happen. It was used by Naiman and Priebe for scan statistics, Shi, Siegmund and Yakir for genomic scans and Adler, Blanchet and Liu for extrema of Gaussian processes. We call it ALOE, for "at least one event". The ALOE estimate is unbiased and we find that it has a coefficient of variation no larger than $\sqrt{(J + J^{-1} - 2)/(4n)}$. The coefficient of variation is also no larger than $\sqrt{(\bar{\mu}/\mu - 1)/n}$ where $\bar{\mu}$ is the union bound. Our motivating problem comes from power system reliability, where the phase differences between connected nodes have a joint Gaussian distribution and the J rare events arise from unacceptably large phase differences. In the grid reliability problems even some events defined by 5772 constraints in 326 dimensions, with probability below 10^{-22}, are estimated with a coefficient of variation of about 0.0024 with only $n = 10{,}000$ sample values.

This talk is based on joint work with Yury Maximov and Michael Chertkov of Los Alamos National Laboratory.