

Spring 2009: Stat 992

A new song in design of experiments: space-filling designs with diverse applications

Time and Place: MED SC CTR 1210, 11:00 AM - 12:15 PM, TR

Instructor: Peter Qian
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Office Hours:
1:15 - 2:15 PM, TR
By appointment

Course description:

It is a common perception that design of experiments (DOE) is a critical tool for experimentation in sciences, engineering and services. Notable examples include Fisher's pioneering work of using factorial designs in agricultural applications and Box's groundbreaking work of developing response surface methodology for optimizing chemical processes. To expand this perception further, in this course I will demonstrate that modern design of experiments methods can play a vital role in diverse areas like numerical integration, complex computer simulations, stochastic optimization and computational statistics, to name a few. In stark contrast to classical designs (ie, D-optimal designs and factorial designs), the designs to be covered in the course are model-free in nature and are roughly called space-filling designs, i.e., designs where the points fill the space uniformly.

Prerequisite:

One master-level course on mathematical statistics. No prior exposure to design of experiments is required.

Topics:

- Review of classical designs.
- Introduction to space-filling designs.
- Latin hypercube designs.
- Better Latin hypercube designs.
- Lattice sampling.
- Nets and quasi-Monte Carlo samples.
- Prediction methods for computer experiments.
- Good model-based designs.
- Sequential space-filling designs.

- Stochastic optimization with space-filling designs.

References:

The course is based on journal papers. But it will be much easier for you to learn if you have “Design and Analysis of Computer Experiments” by Santner, Williams and Notz, SPRINGER, 2003.

Class notes: will be posted on

<https://learnuw.wisc.edu/>

Requirements:

- (a) For one credit, show up (rather frequently).
- (b) For two credits, (a) plus present a journal paper.
- (c) For three credits, (b) plus a class project (either applied or methodological).

I will assign two or three sets of exercises. No need to turn in.