Computer experiments are used for approximating, optimizing and visualizing functions over moderate to high dimensional spaces. The planes we fly in, cars we drive, and the computers we use are designed with extensive computer experimentation, that usually precedes physical experimentation. These functions are usually deterministic, but their complexity and moderately high dimension, invite the use of statistical methods.

The standard methods are based on kriging. They are well suited to settings where the function is expensive to compute and only a few observations may be obtained. But the cost of kriging grows proportionally to the cube of the sample size. For large samples, one spends more computer time processing the data values than generating them.

We propose regression based methods that fit an approximation to the function and interpret the coefficients. In these regressions we can control the distribution of the predictor variables. This allows us to sample in such a way that the $X'X$ matrix in regression has expected value proportional to the identity matrix. The method of quasi-regression (patterned after Chui and Diamond’s quasi-interpolation) exploits the known expected value of $X'X$. Quasi-regression reduces the time and space required for regression on $p$ variables by a factor of $p$ each.

Some example functions are presented. One example is a function of 1,000,000 variables. Using quasi-regression it is possible to investigate the extent to which such a function is nearly linear, with only 100,000 function evaluations.