Experimental Design

4/20/2009

Opening Discussion

- Do you have any questions about the quiz?

- Minute Essay comments

  - I should be around a fair bit during reading days and finals.

  - Why does negative diffusion happen in perturbed rings?

- Power laws, fractals, and the Martian landscape.

2^{k-p} Fractional Factorial

- The "standard" 2^k factorial design method can often require far too many simulations.

- There are approaches where you don't cover the space quite as completely for large k situations yet still get most of the benefit.

- This section of the text has a lot of details in it on how you would design a test suite that doesn't fully investigate certain parameters. It does leave you with some ambiguity though.

Metamodels

- The earlier experimental design plans mainly aimed to allow you to see how a system responds relative to changes in certain variables. They also allowed exploration of mutual changes.

- Often you would like to be able to predict the response of a system based on a few of the factors.

- This basically uses linear regression to fit responses.

Building Models

- The type of model that you can build will depend a lot on the number of different values you try for each factor.

- With only two values, the model has to have no more than two parameters and will likely be linear. Larger numbers of data points can give you higher order fits.

- You want fits, not just interpolating of data.

Response Surfaces

- Another way to model data is to build a response surface.

- This is basically like what I showed you for my ring simulations.

- You vary 2 factors through a few values to form a surface of responses.

- If you had the right visualization software/hardware you might try to build a response space, but it can be harder to interpret.

Simulation Based Optimization

- Optimization is a field unto itself.

- The challenge with simulation is that evaluating new points in the parameter space can be costly.

- Unconstrained optimization basically uses Newton's method in a higher dimensional space. Derivatives typically taken numerically.

- Constrained optimization places bounds on where the solution can be. Linear programming.

Minute Essay

- Any questions?

- The second test will be on Friday. It will cover material we have done since the midterm.