

Title: Latin Hypercube Designs for SPICE modeling

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Abstract:

As semiconductor technologies move towards smaller geometries and the roadmaps to attain production quality units become more and more aggressive, assessing the performance of new designs before first silicon has become a critical part of technology development. Computer experiments are the typical vehicle for testing the capability of significant revisions to current designs or completely new architectures.

Computer experiments are unlike physical experiments in that the models are deterministic in nature. There is no random error term so ideas such as replication, blocking, and the usual alphabetic-optimality criterion are not necessary or are not readily applicable. Computer experiments frequently use many more input variables or factors than physical experiments, and the mathematical models relating the inputs to the output variable(s) are often extremely complex requiring tremendous compute time for one realization. Thus, designs for computer experiments must meet different requirements than designs for physical experiments. For example, in computer experiments no replication and a small number of observations are both highly desirable qualities.

SPICE is a general-purpose circuit simulation software for nonlinear dc, nonlinear transient, and linear ac analyses. The software has built-in models for specific semiconductor devices. The purpose of this presentation is to discuss the use of Latin Hypercube Sampling (LHS) as an efficient front-end input selection procedure for SPICE modeling. We will discuss the basic ideas behind computer experiments, define LHS and discuss its similarity to other space-filling designs. Then assess the efficiency of LHS designs relative to simple random sampling in a small SPICE modeling simulation where the goal is to characterize the distributions of two response variables. Finally, we will discuss briefly the use of computer experiments to predict a response surface.