Design of Experiments

Optimal Design Analysis for Signal Integrity

EXPLORE SOLUTION SPACE WITH MILLIONS OF CONFIGURATIONS WITH ONLY A FEW HUNDRED SIMULATIONS

Design of Experiments (DOE), a methodology developed from decades of manufacturing studies, is a powerful approach to solving complex problems. Instead of exhaustively simulating a solution space, the DOE approach statistically samples the space with the goal of characterizing the space with a mathematical model of its behavior. Once the simulations have been run and a model fit has been validated, the model allows the signal integrity designer to quickly and efficiently explore the solution space.

Analysis Flow

## SEAMLESS INTEGRATION WITH JMP® STATISTICAL DISCOVERY SOFTWARE

JMP® Statistical Discovery Software has been integrated into QCD and QSI to be able to leverage the strengths of each tool. Setup and define the experiment in QCD/QSI, create the DOE sampling set in JMP, quantify system performance in QCD/QSI and perform model fit and explore the solution space in JMP. The tight integration allows for information to be passed back and forth between the tools with a click of a button. Use the QCD/QSI Setup DOE feature to define how the solution space is represented by the DOE factors. This allows for many-to-one and one-to-many mapping capabilities for relating solution space variables to both continuous and categorical DOE factors. Overall, the integration between QCD/QSI and JMP allows for rapid analysis so that you can gain the needed experience to be confident with applying the DOE approach, understanding its limitations and leveraging its capabilities.

Setup DOE

## OPTIMIZE DESIGN PARAMETERS AND QUANTIFY IMPACT OF MANUFACTURING VARIANCE

A properly designed experiment can provide opportunities to optimize the interconnect channel, find the best transmit or receive equalization and position the design to be robust to manufacturing variations. Optimize over multiple metrics simultaneously, perform virtual what-if analyses and rank the input variables for their impact on system performance.
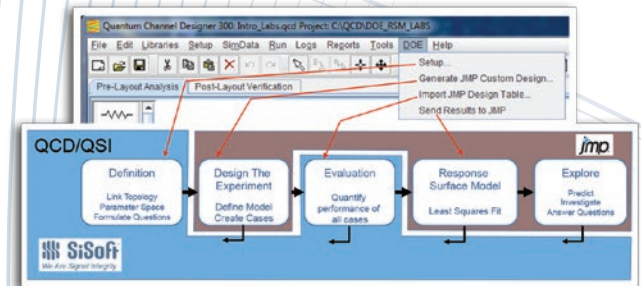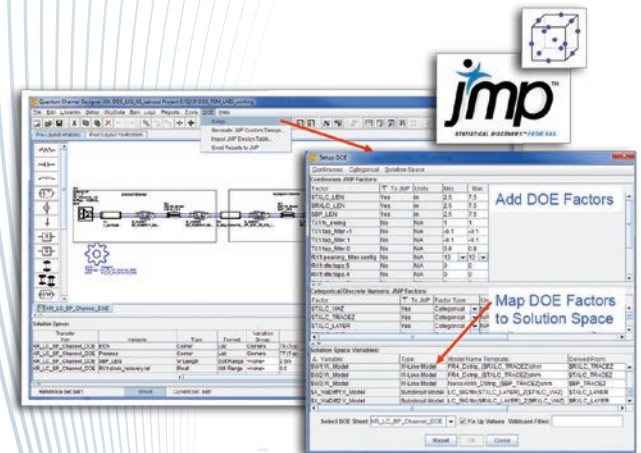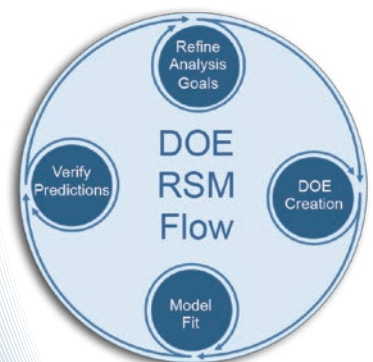
PERFORM DPM/UPM ANALYSIS TO ESTIMATE MANUFACTURING YIELD

Estimate the DPM (Defects per Million) or UPM (Units per Million) rate of the interface by including the distributions of the PCB impedance, package impedance and silicon PVT. This allows for the simulation of millions of system configurations in just seconds to build a yield curve from which the DPM/UPM rates are obtained. Determine if you are over or under designing your system from a manufacturing yield point of view.
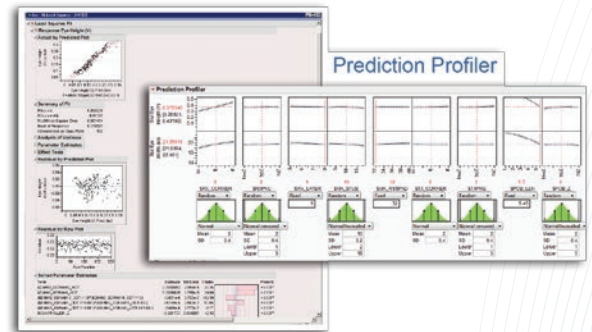

Response Surface Model

CUT YOUR ANALYSIS ITERATION TIME FROM WEEKS TO HOURS

QCD/QSI with DOE allow for much faster iteration time to go from question to answer. Once a satisfactory DOE and model fit have been found, analysis iterations to consider minor system changes take minutes to hours to complete instead of days to weeks.

## QUANTIFY AND UNDERSTAND THE IMPACT OF UNCERTAINTIES

QCD/QSI with DOE requires a new mindset of quantifying and understanding the uncertainty of the analysis and bounding this within confidence intervals. This is much better than the alternative to hope that the uncertainty is small and that it won't hurt much.
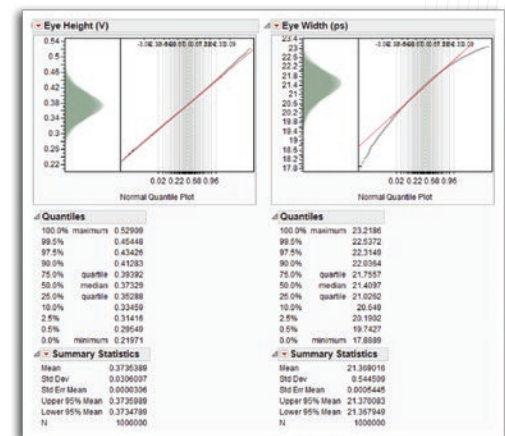
Performance Yield

EXPERIENCE SISOFT'S TWO DAY DOE TRAINING COURSE

SiSoft's two day DOE training course covers the basics to advanced topics and is designed to prepare you to apply the DOE approach to your own interface design challenges. Topics include Basic DOE creation, Basic Model Fit, Validate the Model Fit, Explore the Model, Advanced DOE creation, Advanced Model Fit, Defects Per Million Analysis, Application to 10G KR Ethernet Interface Design, Application to DDR4 ODT Optimization and other advanced topic labs.
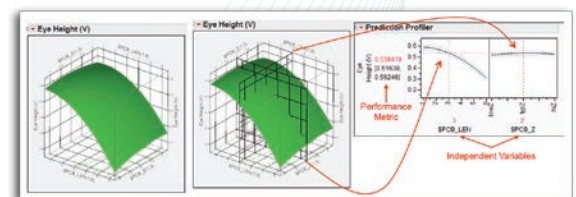
Multi-Dimensional Analysis

To learn more about SiSoft's products, contact sales@sisoft.com or visit our website at www.sisoft.com.

SiSoft™
We Are Signal Integrity

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