Statistical Engineering Division Seminar

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Lecture Room A, Administration Bldg.
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Minimum Aberration Split-Plot Designs

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In multifactor fractional-factorial experiments, it is often not practical to run all the factors in a completely random order. In such a case, a split-plot design can be used as an efficient tool. For example, in thin-film experiments, factors such as temperature and amount of ionization can only be varied on large units of experimental material, while factors such as substrate and subsequent cleaning can be varied on smaller units of material. Usually, such a split-plot design is obtained by combining two separate fractional-factorial designs, one for the whole plot and one for the subplot. We show how such a design can be improved, sometimes greatly, by extending the concept known as minimum aberration.

We first show a general approach to creating minimum-aberration fractional-factorial split-plot designs. We then show examples in which such designs may be created directly from minimum-aberration fractional-factorial (non-split-plot) designs. For the general case, we illustrate how the problem can be solved by linear integer programming. We present examples of such solutions. We finally argue that such designs should be used to improve the inner-outer-array method sometimes used in robust design. Our presentation employs only two-level designs, but these ideas can be extended to other important cases, including three-level designs. This presentation is based on work done jointly with Peng Huang (thesis), currently at University of Rochester, and Dechang Chen, at University of Buffalo.

Joe Voelkel is an Associate Professor at RIT, teaching graduate courses in applied statistics, frequently to engineers wishing to meet the demands of a noisy world. He was previously employed as a statistical consultant at Allied-Signal, and continues to consult in a wide variety of industries. Dr. Voelkel received his BS in Mathematics from Rensselaer Polytechnic Institute, his MS in Industrial Engineering/Management Sciences from Northwestern University, and his Ph.D. in Statistics from University of Wisconsin, Madison. He serves on the editorial board of Quality Engineering, has been actively involved in the Statistics Division of ASQC, and is currently the Secretary for the Q&P Section of the ASA. He was recently a finalist for RIT's Outstanding Teacher award and is currently writing a text on modern uses of experimental design, which he hopes to have at least a draft of before the next millennium.

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