Incorporating Column Information in Selecting Efficient Model-Robust Factorial Designs

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Abstract

Model-robust designs have been studied extensively in the literature. These designs are employed to achieve robustness over a set of possible models, which are usually assumed to have equal probability to be the true model. However, they may not be appropriate for experiments where prior knowledge indicates that effects involving certain factors are more likely to be significant than others. In such cases, it is important to select designs that have superior estimation capacity and information capacity over a subset of the model space that contains models that are more likely to be important. This can be achieved by assigning the factors to the columns of a fractional factorial design in a strategic manner. We propose the individual estimation capacity (iEC) and individual information capacity (iIC) and use these criteria to distinguish columns of a factorial design. For a given design, we tabulate the maximum number of columns, g, for which iEC=100%. We propose a new class of designs that maximize g, and we evaluate the trade-offs between the number of runs, the number of columns, and g. The emphasis is on the model space that consists of models containing a subset of main effects and their associated two-factor interactions.