Chapter 9: Multi-factor experiments

Introductory Statistics for Engineering Experimentation

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Outline

Chapter 9: Multi-factor experiments

- We are not limited to using two factors in an experiment. Especially in screening experiments, where we are seeking to distinguish the "important few" factors from the "trivial many", it is useful to incorporate many factors.
- Incorporating many factors, each with several levels, results in a large number of combinations of levels. If we want replicates the situation is even worse.
- One way to reduce the number of experiments required is to use a small number of levels, which is why we often use just two levels.
- At two levels, there is no distinction between a numeric covariate, a categorical covariate or an ordered category. For technical reasons we often represent such a factor as an ordered category.

Section 9.1: ANOVA for multi-factor experiments

- For a replicated design we proceed as for two-factor experiments and fit a model with all possible interactions.
- We check the highest-order interaction first. If it is not significant we re-fit without that term and continue checking. In a balanced factorial design omitting certain interactions will not change the estimates of coefficients for other interactions, but it will change MS_e.
- The formula for model with all possible interactions has $*$ between the factors.
- We can modify the formula by "subtracting" particular terms.