

A Two-Stage Design for Experiments with Sliding Levels

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Abstract: Design of experiment with related factors can be implemented by using the technique of sliding levels. In a sliding-level experiment, the desirable experimental region is irregular, which is different from the cubical or symmetric regions considered in most design papers. Taguchi (1987) proposed an analysis strategy by re-centering and re-scaling the slid factor. Hamada and Wu (1995) showed by a counter example that in many cases the interactions cannot be completely eliminated by Taguchi's strategy. They proposed an alternative method in which the slid factor is modeled by nested effects. These works implicitly assume that the irregular shape of the experimental region is known beforehand. In practice, we often encounter sliding-level experiments whose desirable regions are unknown. We propose a two-stage design for such experiments, which in the first stage explores and decides an appropriate experimental region, and in the second stage studies the response by systematically distributing the design points on the region identified in the first stage. The analysis methods developed especially for the two-stage design will also be discussed in the talk. Finally, the methodology will be illustrated by an application to resistant spot welding experiments.

References

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