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Applying Modified Central Composite Designs to Solve Robust Parameter Problems

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Abstract: In a robust parameter problem, the controllable factors of interest in a process are modeled along with the uncontrollable or noise factors with the goal of finding settings of the control factors that are insensitive or "robust" to noise variability. Taguchi's methodology has been successful in numerous applications for solving robust parameters problems; however, some researchers have found some limitations in these applications. Consequently, response surface methodology has been applied as an alternative to Taguchi's methodology to find the optimal factor settings. The research presented here analyzed four production processes using both Taguchi's methodology and response surface methodology to find the appropriate levels for the control factors. These processes included two cases with two control factors and one noise factor, and two cases with three control factors and two noise factors. The processes were simulated using the Logicon Process Simulator™. Both Taguchi's and response surface methodology were applied to the same experimental region defined in the vicinity of the optimum settings. This vicinity was obtained using the steepest ascent method. Results indicated that response surface methodology provided equal or better solutions than Taguchi's methodology. On the other hand, regarding the number of experimental runs, for the cases with a small number of factors, Taguchi's methodology required fewer runs; and for the cases with a larger number of factors, response surface methodology required fewer runs.

Keywords: robust parameter design, response surface methodology, steepest ascent, Taguchi methods, design of experiments