

# **A General Approach to Confidence Regions for Optimal Factor Levels of Response Surfaces**

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## **ABSTRACT**

For a response surface experiment, an approximate hypothesis test and an associated confidence region is proposed for the minimizing (or maximizing) factor-level configuration. Carter et al. (1982) show that confidence regions for optimal conditions provide a way to make decisions about "therapeutic synergism". The response surface may be constrained to be within a specified, bounded region. These constraint regions can be quite general. This allows for more realistic constraint modeling and a wide degree of applicability, including constraints occurring in mixture experiments. The usual assumption of a quadratic model is also generalized to include any regression model that is linear in the model parameters. An intimate connection is established between this confidence region and the Box-Hunter (1954) confidence region for a stationary point. As a byproduct this methodology also provides a way to construct a confidence interval for the difference between the optimal mean response and the mean response at a specified factor level configuration. The application of this confidence region is illustrated with two examples. Extensive simulations indicate that this confidence region has good coverage properties.