The TSR-MM based on robust location and scales measures in dual response optimization in the presence of outliers and heteroscedastic errors

ABSTRACT

The dual response surface optimization approach is commonly used in an industrial process to simultaneously optimize the process sample mean and the process sample standard deviation functions.The short coming of this approach is that the sample mean and the sample variance are used to fit the process mean and process variance functions based on the OLS method.However,these estimators are very sensitive to outliers or departures from the normality assumption.The OLS estimates do not give good results when both outliers and heteroscedastic errors exist concurrently. As a consequence,the optimum operating conditions may be located far from the true optimum values. In order to make significant improvements in robust design studies,robust location(median)and robust scales estimates(Median Absolute Deviation(MAD)and Interquartile Range (IQR)) of the response variables are employed for dual response surface optimization.Two-stage robust estimator based on MM-estimator (TSR-MM based) based on robust location and robust scales estimates is proposed to simultaneously remedy the problem of heteroscedastic errors and outliers.The results of the study indicate that the TSR-MM based on robust location and scales estimates provide a significant reduction in the bias and variance of the estimated mean response.

Keyword: Dual response surface model; Outliers; optimization; Robustlocation; Robustscales; Robust MM-estimator