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Abstract

Gauge study considers both repeatability and reproducibility of the measurement system. The assessment of GR&R provides objective policy-making data not only ensuring accuracy but also ensuring precision of the measurement system within the controllable range for monitoring the manufacturing process. Therefore, only qualified measurement technology can guaranty the manufacturing process and the product quality in the state of statistical control.

Methods to estimate repeatability and reproducibility contain ANOVA method, Classical GR&R method, and Long Form method. In the past, the measurement system usually utilized the method of ANOVA to analyze the measurement system while there was interaction between operators and parts. Classical GR&R and Long Form methods can not be used to estimate the variation with interaction between operators and parts. Therefore, the research modified the two methods not only making them applicable in the case of interaction between operators and parts but also providing unbiased gauge variance estimators. This improved the shortcoming of gauge analysis using the concept of control chart.

Meanwhile, the research compared the gauge variance estimators of different estimation methods by simulating a measurement system based on the criterions of the biasness, variance, and mean squares error of the gauge variance estimates. The research showed that the ANOVA method produces unbiased gauge variance estimator. While taking accuracy and precision into consideration simultaneously, the modified gauge variance estimator of the research is the best one. In addition, the research also discussed the parameter values of the measurement system which are sample size, number of operators, and repetition number per operator. It is suggested that one must consider increasing the number of operators first, sample size the second and repeated measurements the last.
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