Performance Measures for Robust Design and its applications

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Abstract

The Taguchi methods are widely used for parameter design to make products more robust to variations of environmental conditions. Taguchi has proposed various performance measures known as Signal-to-Noise (SN) ratios for evaluating the performance of signal-response systems (see Taguchi (1986)). However, from the model approach, the SN ratios do not always minimize quadratic loss.

In this paper, we first describe a generalized SN ratio based on average log quadratic loss. This SN ratio is an equivalent of a performance measure for evaluating a variation related to the dispersion parameter for data with positive values.

Next, we discuss the testing of SN ratios for homogeneity based on experimental data to compare the performance of signal-response systems. With Taguchi' SN ratios, the problem is solved by testing the homogeneity of error distributions as normal distributions (Nagata, Miyakawa and Yokozawa (2003)). We use the log-SN ratio (a dimensionless evaluation measure proposed for use with positive-valued data: Kawamura and Iwase (2007), Kawamura and Iwase (2009)) to derive the distribution of test statistics based on a certain hypothesis. We also discuss data analysis based on actual data (e.g., automotive suspension system).

References

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