

Integration of Grey-Based Taguchi Method and Principal Component Analysis for Multi-Response Decision-Making in Kansei Engineering

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ABSTRACT

This paper presents a hybrid method to determine the optimum combination of product form features in Kansei engineering. This method integrates the Taguchi method and grey relational analysis (GRA) coupled with principal component analysis (PCA). Experiments are performed on a variety of passenger car form designs. The Taguchi's L27 OA is chosen to design the experiments and to generate the car silhouettes as design samples. GRA is used to solve the multi-response optimisation problem, while PCA is used to assign the weighting values of relevant Kansei responses. The results show that the hybrid method was able to solve the complexity trade-off encountered in the decision-making process of multi-response optimisation using an economical and effective experimental design method. The method also has the capability in determining the optimum combination of product form features and generating an optimised car form design which accommodates the multi-Kansei need of consumers in a systematic manner.

KEYWORDS: Taguchi methods, grey relational analysis, GRA, principal component analysis, PCA, multi-response optimisation, decision making, product form design, Kansei engineering, product form features, automobile industry, vehicle design, vehicle silhouettes, experimental design, customer needs, automotive manufacturing

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