Optimization of MIMO Plastic Injection Molding Using DOE, BPNN, and GA

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Abstract

This study proposes an optimization approach to generate the optimal process parameter settings of multiresponse quality characteristics in the plastic injection molding (PIM) products. Taguchi method was employed to arrange the experimental work and to calculate the S/N ratio to determine the initial process parameter settings. The back-propagation neural network (BPNN) was employed to construct an S/N ratio predictor and a quality predictor. The S/N ratio predictor was along with genetic algorithms (GA) to generate the first optimal parameter combination for multiple-input multiple-output (MIMO) plastic injection molding. Besides, the afore-mentioned BPNN quality predictor was combined with GA to find the second optimal parameter settings. The quality characteristics, product length and warpage, were dedicated to finding the optimal process parameter settings for the best quality specification. The significant control factors of optimization process influencing the product quality and S/N ratio were determined using experimental data based on analysis of variance (ANOVA). Experimental results show that the proposed approach can create the best process parameter settings which not only meet the quality specification, but also effectively enhance the PIM product quality and reduce cost.

Keyword：Plastic injection molding; Taguchi method, Backpropagation neural network; Genetic algorithms; Analysis of ANOVA