A two-stage optimization system for the plastic injection molding

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Abstract

In the current plastic injection molding (PIM) industry, most products have been full of diversified and variety. Every product, however, has its own process parameter settings created by engineers relying on their previous experiences or trial-and-error method, which results in wasting time and cost. With the increasing complexity of product, this study proposes a two-stage optimization system to generate the optimal process parameter settings of multi-quality characteristics in the PIM products. In the first stage of this study, Taguchi orthogonal array was employed to arrange the experimental work and to calculate the S/N ratio to determine the initial process parameter settings. Besides, the back-propagation neural networks (BPNN) was employed to construct an S/N ratio predictor and a quality predictor. The S/N ratio predictor was along with GA to search for the first optimal parameter combination. The purpose of this stage is to reduce the PIM process variance. In the second stage, the afore-mentioned BPNN quality predictor was combined with particle swarm optimization (PSO) to find the optimal parameter settings, and the quality characteristics, product length and warpage, were dedicated to finding the optimal process parameter settings for the best quality specification. Experimental results show that the proposed two-stage optimization system 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; Back-Propagation Neural Networks; Genetic Algorithms;