

兩階段最佳化系統應用於多品質特性塑膠射出成形之研究

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摘要

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 try-and-error method, which results in doing numerous tests and wasting much time. 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.

The study falls into two stages. In the first stage, the experimental results (data) via Taguchi orthogonal array can be used to calculate the S/N ratio and conduct Analysis of Variance (ANOVA) to determine the initial process parameter settings. Besides, the back-propagation neural network (BPNN) is carried out to construct an S/N ratio predictor along with the GA global search and significantly reduce the PIM process variation to minimum. In the second stage, the afore-mentioned BPNN quality predictor combined with particle swarm optimization (PSO) to implement the local search and draw close to the target of specification; finally, the quality characteristics (i.e., product length and warpage) are dedicated to finding the most stable and optimal process parameter settings which can entirely meet the quality specification.

Research results show that the proposed two-stage optimization system can create the best process parameter settings which not only meet the length specification, reduce the parts' warpage and mode trying times, but also effectively enhance the PIM product quality.

關鍵字 : plastic injection molding, Taguchi methods, neural networks, genetic algorithms, particle swarm optimization