An integrated parameter optimization system for MISO plastic injection molding

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Abstract

This paper presents the development of a parameter optimization system that integrates mold flow analysis, the Taguchi method, analysis of variance (ANOVA), back-propagation neural networks (BPNNs), genetic algorithms (GAs), and the Davidon-Fletcher-Powell (DFP) method to generate optimal process parameter settings for multiple-input single-output plastic injection molding. In the computer-aided engineering simulations, Moldex3D software was employed to determine the preliminary process parameter settings. For process parameter optimization, an L25 orthogonal array experiment was conducted to arrange the number of experimental runs. The injection time, velocity pressure switch position, packing pressure, and injection velocity were employed as process control parameters, with product weight as the target quality. The significant process parameters influencing the product weight and the signal to noise (S/N) ratio were determined using experimental data based on the ANOVA method. Experimental data from the Taguchi method were used to train and test the BPNNs. Then, the BPNN was combined with the DFP method and the GAs to determine the final optimal parameter settings. Three confirmation experiments were performed to verify the effectiveness of the proposed system. Experimental results show that the proposed system not only avoids shortcomings inherent in the commonly used Taguchi method but also produced

significant quality and cost advantages.

Keyword：Parameter optimization . Mold flow analysis . Taguchi method. ANOVA. GAs. DFP. Plastic injection molding