

Warpage analysis on thick shell part using response surface methodology (RSM) and bat algorithm (BA) to optimize parameter setting in injection molding process

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ABSTRACT

Injection molding is a common process to manufacture plastics parts with low cost. During Injection Molding Process (IMP), many types of defects would occur on the plastics parts and affect its quality. Warpage is one of the common types of defects and it is due to the differential shrinkage in plastics parts. Although warpage is difficult to avoid, but it can be reduced by various methods such as Response Surface Methodology (RSM) and Bat Algorithm (BA). In order to reduce the warpage, this research focuses on simulation and optimization of the process parameters setting. Autodesk Moldflow Insight (AMI) 2012 software is used to simulate and determine the range of parameters setting that affect warpage on thick shell parts. RSM is used to optimize process parameters setting and reduce warpage problem during IMP by Design of Experiment (DOE) based on the recommended parameter setting in AMI. RSM also predicts mathematical modelling and is further used in BA. BA will optimize the process parameters setting and improve warpage value based on the results in AMI. Both RSM and BA are used to find the optimum IMP parameters to reduce warpage on the thick shell plastic parts. The recommended setting based on AMI shows that the warpage at X-axis is 0.6546 mm. After optimization, results at warpage X of RSM and BA had reduced to 0.5612 mm and 0.5279 mm respectively. RSM and BA optimization shows improvement of warpage by 14.27% and 19.36% respectively. The significance of this study is to minimize warpage during IMP and optimize the process parameter setting of injection molding by using RSM and BA. Plastic parts without warpage are beneficial to the industrial, because they will reduce cost consumption during the assembly process and produce qualitative plastic products during IMP.

KEYWORDS

Response surface methodology; Injection molding process; Parameters setting; Plastic products

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