G09.19

Optimization of Injection Molding Using Numerical Simulation with the Surrogate Model Approach

Jian Zhou, *Lih-Sheng Turng

Department of Mechanical Engineering, University of Wisconsin-Madison, USA

With the help of sophisticated 3D simulation for injection molding, the engineers can obtain process insights, pinpoint overlook problems, and provide improved solutions. However, the time-consuming iterations of 3D simulation and the complex nonlinear interactions among the various process variables make it difficult to determine the optimal operating conditions. Using regression techniques to establish the surrogate models to approximate the computationally intensive simulations allows quick evaluation of alternatives and system-level decision making and optimization. In this work the performance of four surrogate modeling techniques, namely, artificial neural network (ANN), Gaussian process (GP), support vector regression (SVR), and response surface methodology (RSM), are compared in terms of accuracy, robustness, efficiency and simplicity. It was found that GP achieved better performance than the other three techniques. The GP model not only returns a prediction along with the most likely value, but also gives an estimate on the confidence in that prediction. In this study, the Genetic Algorithm (GA) combined with a local pattern search algorithm was used to evaluate the GP surrogate model to search for the global optimal solutions in a concurrent fashion within a reasonable time frame. This procedure will intelligently identify the points with the maximum variance in the design space and select these as the next sampling points to adaptively update and improve the surrogate model.