Abstract

This paper presents a methodology for robust optimization of Genetic Algorithm (GA) involving complex interactions among the control parameters. Finding the Optimum GA parameters to solve an optimization problem for producing best results with least variability is still an open area of research.

The proposed research approach primarily covers the robust optimization of Genetic Algorithm control parameters using Taguchi Design of Experiment (DOE) with a special set of L25 orthogonal array (OA). The experimental design and the study is conducted with MATLAB Genetic Algorithm internal control parameters using real-coded Genetic Algorithm fitness functions operates directly on real values of two different case studies. One of them is based on experimental data for the development of a new product and the other one is based on the historical data of an existing product under large scale complex manufacturing system. The performance characteristics (Best fitness value) of GA are evaluated. The main effect for signal-to- noise ratios (SNR), main effect for means, response tables and analysis of variance
(ANOVA) are employed and optimum parameter settings are obtained. The confirmation experiments are carried out with the optimum setting parameters and the results are compared with the predicted & default setting values of GA.

The experimental results show an increase of signal-to-noise ratio (SNR) by around 54 % and mean by 12 to 25 % from the default setting of GA to the optimum settings arrived during the experimental process, which are extremely significant. Further, cross over was found to be the most influential parameter for both the case studies, followed by other parameters like population size, selection process for case study-1 and mutation rate, population size for case study-2. It is evident that the GA performances are also sensitive to the objective function (transfer function in GA terms).

The study clearly shows the robust optimization of GA parameters leading to best level of performance characteristics with least variability for the solution of real life optimization problem, using Taguchi Experimental Design Techniques.

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Genetic Algorithm Parameter Optimization using Taguchi Robust Design for Multi-response Optimization of Experimental and Historical Data


Index Terms

Computer Science
Algorithms

Keywords

Genetic Algorithm (GA), Parameter Optimization, Taguchi Robust Design, Design of Experiments (DOE), ANOVA, Experimental and Historical data.