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Optimization of process performance by multiple pentagon fuzzy responses: Case studies of wire-electrical discharge machining and sputtering process

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ABSTRACT

This research developed mathematical models to optimize process performance for multiple pentagon fuzzy quality responses. Initially, each quality response was represented by a pentagon membership function. Then, the combination of optimal factor levels was obtained for each response replicate. Those optimal combinations were then used to construct pentagon regression models for each response. A pentagon fuzzy optimization model was formulated and solved to determine the combination of optimal factor levels at each element of pentagon response's fuzzy number. Two real case studies, i.e. wire-electrical discharge machining and sputtering process, were provided for illustration. Optimal results of the two case studies revealed that the proposed procedure effectively optimized performance under uncertainty and provided larger improvement in multiple quality characteristics. In conclusion, the proposed procedure may enhance the process engineer's knowledge about effects of uncertainty on process/product performance and help practitioners decide the proper adjustments of factor levels in order to enhance performance of electrical discharge machining and sputtering process.

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