Modelling and Optimization of Laser Cutting Operations

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Abstract : Laser beam cutting is one nontraditional machining process. This paper optimizes the parameters of Laser beam cutting machining parameters of Stainless steel (316L) by considering the effect of input parameters viz. power, oxygen pressure, frequency and cutting speed. Statistical design of experiments are carried in three different levels and process responses such as 'Average kerf taper (Ta)' and 'Surface Roughness (Ra)' are measured accordingly. A quadratic mathematical model (RSM) for each of the responses is developed as a function of the process parameters. Responses predicted by the models (as per Taguchi's L27 OA) are employed to search for an optimal parametric combination to achieve desired yield of the process. RSM models are developed for mean responses, S/N ratio, and standard deviation of responses. Optimization models are formulated as single objective problem subject to process constraints. Models are formulated based on Analysis of Variance (ANOVA) using MATLAB environment. Optimum solutions are compared with Taguchi Methodology results.

Keywords : optimization, laser cutting, robust design, kerf width, Taguchi method, RSM and DOE

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