International J. of Engg. Research & Indu. Appls. (IJERIA).
ISSN 0974-1518, Vol.4, No. III (August 2011), pp 427-454

EMPIRICAL MODELING OF BEAD GEOMETRY AND OPTIMIZATION IN LASER BEAM WELDING

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Abstract

Laser beam welding (LBW) is a field of growing importance in industry with respect to traditional welding methodologies due to lower dimension and shape distortion of components and greater processing velocity. Because of its high weld strength to weld size ratio, reliability and minimal heat affected zone, laser welding has become important for varied industrial applications. In this work Butt welds were carried out on INCONEL 600 plates using pulsed ND:YAG Laser beam welding machine. The overall goal of this research is to model and optimize Laser beam welding process. The primary requisite to automate a process is to develop the governing relationships between process parameters and weld bead geometry. Accurate prediction mathematical models to estimate Bead width, Depth of Penetration & Bead Volume were developed from experimental data using Response Surface Methodology (RSM). These predicted mathematical models are used for optimization of the process. Total volume of the weld bead, an important bead parameter, was optimized (minimized), keeping the dimensions of the other important bead parameters as constraints, to obtain sound and superior quality welds. Further the optimization of weld bead volume was carried out using the optimization module available in the MATLAB 2010a version software package.

Keywords: ND-YAG Laser Beam welding, Weld bead geometry, Response surface methodology, Constraints, Genetic algorithm, Optimization.