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# Gas Metal Arc Welding Procedure Optimization using Mathematical Modeling and Meta-heuristic Firefly Optimization Algorithm based on Learning Automata

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## Abstract

Gas metal arc welding (GMAW), also referred to as metal inert gas (MIG) welding or metal active gas (MAG) welding, is among the most commonly used joining procedures in industrial and especially military applications, due to its unique characteristics such as good penetration, low distortion and applicability in automated welding systems. The study and analysis of this procedure is thus deemed necessary. Since there are numerous control parameters involved in achieving quality joints, a thorough understanding of the procedure and its influential parameters as well as the mechanics of their effect on mechanical and metallurgical characteristics of the weld are imperative.

MGAW involves various input parameters with each exerting their unique effects on the quality of the final weld. Determination of the influence of each parameter along with their significance, is an arduous task which demands precise study of the procedure through laboratory experiments and computer analysis. The present study therefore attempts to undertake experimental studies as well as statistical analysis, in order to investigate the procedural behavior and its effective parameters. In addition, a method is presented which will be used to determine the optimal levels of the welding procedure parameters required to achieve the desired outcome.

**Keywords**: mathematical modeling, optimization, arc welding, Firefly algorithm.

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