



Optimization of Weld Bead Geometry for Cold-Rolled Thin Steel Plate Lap Joints using ColdArc Welding

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The profile of weld bead geometry plays a vital role in establishing the joint quality of lap configurations. Refining these geometric attributes is crucial for maintaining the robustness of the structure, particularly within automotive applications. It remains challenging to join thin plates effectively by optimizing process parameters to achieve compatible joints. This study aims to examine the interaction between parameters by developing mathematical equations to predict the bead geometry in ColdArc welding. The experiments were set-up using ER70S-6 steel wire on cold-rolled structural workpieces. Shielding was provided by a gas mixture of 80% Argon and 20% CO₂ with a 1.0 mm diameter mild steel filler wire. A set of experiments was performed to collect data using the Central Composite Design (CCD) technique of Response Surface Methodology (RSM). A total of 20 experiments were conducted based on the RSM design. The results of the confirmation experiments demonstrated that the developed mathematical models could predict the bead geometry with reasonable accuracy. This study proved that interaction effects play a major role in determining bead dimensions. The process successfully minimized the bead width and bead height parameters using RSM.