Abstract

Welding is a reliable cost effective and efficient metal joining process, and it is also an essential process in the steel structure manufacturing. The welded joints are an important factor in the structure safety.

The present work presents a practical and analyzed studying on the effect of the welding process variables on the temperature distributions and the mechanical properties of the welded joints. Three welding passes GMAW with shield gas of Carbon dioxide and electrode of SG3 of constant diameter in single-V- groove butt-joint of certain size and material are investigated.

A set of thermal cycles and temperature distributions are measured during the welding process at different welding variables (welding voltage, welding current, welding speed, welding position, and interpass temperature) by thermocouples with suitable diameter fixed along the welding line at the HAZ. The DAQ modules are connected with the computer during the temperature measuring to convert the signals of the thermocouples from analog to digital. A relationship between the welding variables and the mechanical properties of the welded joints are discussed. An empirical correlation is fitted to help in the prediction of the tensile strength without using destructive tests

A mathematical model was prepared to solve the energy equations by using finite difference method. The thermal cycles and the temperature distributions along the welding line at any welding variables can be predicted. A comparison between the computer model and the measured data is done.

Finally, theoretical and experimental results have been compared and analyzed to study the effect of the welding process variables on the mechanical properties and temperature distributions of the welded joints.

So the quality of the welded joints can be predicted by using the mathematical model and the empirical correlation with out the need of the destructive test.