ABSTRACT

A Galerkin method of weighted residual process has been applied in the finite element analysis of the temperature histories in the submerged-arc welded structures. Linear hexahedrons in a space-time domain have been used as the finite elements. The effects of temperature dependent properties such as thermal conductivity, specific heat and that of other factors like latent heats, heat flux radius have been incorporated in the analysis. The programs developed for this analysis have been tested by verifying a few of the published results of one- and two-dimensional heat conduction problems including weld temperature histories. Experiments have been conducted to measure the temperature histories. The effects of heat input, plate thickness, welding speed have been studied. Metallurgical studies to evaluate the width of the heat-affected zone and penetration, and maximum temperature undergone by the different zones have been made. Few of the experimental results have been compared with those obtained by the finite element analysis. The Galerkin approach has resulted in better accuracy than other numerical methods and the method was found to be stable and convergent to the exact solution.

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