Hybrid Spline Difference Method for Heat Transfer in Ultrasonic Welding

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Abstract: The hybrid spline difference method is developed to solve the nonlinear equation of welding problem in ultrasonic welding. It is shown that the hybrid spline difference method has the computational procedure as simply as the finite difference method. In addition, the proposed method can simplify the complexity of the traditional spline method calculation, and increase the accuracy of the first and second derivatives of space from $\mathrm{O}(\Delta x^2)$ of finite difference method to $\mathrm{O}(\Delta x^4)$. According to the obtained temperature distribution in the work pieces during the ultrasonic welding process, the proposed method illustrates that not only its precision was greatly enhanced, but also its concept was very similar to that of the finite difference method. Based on analysis results, the simple and high-accuracy hybrid spline difference method has a strong potential to substitute the traditional finite difference method.

Keywords: ultrasonic metal welding, hybrid spline difference method, finite difference method.

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