Heat source models for numerical simulation of laser welding processes

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In recent decades, numerical modeling and computer simulation have become an integral part of the design, analysis and optimization of fusion welding processes, including laser welding [1-2]. In general, laser welding processes involve the interaction of multiple physical phenomena, such as thermal, fluid, metallurgical, chemical, mechanical, and diffusion effects, which makes the development of a simulation model difficult and complex. In addition to the geometric characteristics of the parts to be welded, their material properties must be specified in a wide temperature range, as well as the conditions for heat removal to the environment or shielding gas. One of the most complex tasks in the preparation of a simulation model of the laser welding process consists in the selection of an appropriate heat source model to accurately determine the heat input to the weld [3-6]. Very important is also the process of experimental verification and validation of the developed simulation models [7].

In this paper, a short examination of significant 3D mathematical heat source models for numerical simulation of laser welding is provided. Numerical analysis of laser welding of aluminum sheets is accoplished using selected 3D heat source models with the support of the ANSYS code. The achieved results are compared and discussed with respect to the specific parameters that characterize individual heat source models.

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