NUMERICAL ANALYSIS OF TEMPERATURE FIELD DURING HARDFACING PROCESS AND COMPARISON WITH EXPERIMENTAL RESULTS

by

Vukic N. LAZIĆ[*1], Ivana B. IVANOVIĆ[2], Aleksandar S. SEDMAK[3], Rebeka RUDOLF[4], Mirjana M. LAZIĆ[5] and Zoran J. RADAKOVIĆ[3]

[1]Faculty of Mechanical Engineering, University of Kragujevac, Serbia
[2]Innovation Center of Faculty of Mechanical Engineering,University of Belgrade, Belgrade, Serbia
[3]Faculty of Mechanical Engineering, University of Belgrade, Serbia
[4] Faculty of Mechanical Engineering, University of Maribor, Maribor, Slovenia
[5]Faculty of Sciences, University of Kragujevac, Kragujevac, Serbia

Original scientific paper
DOI: 10.2298/TSCI130117177L

The three-dimensional transient nonlinear thermal analysis of the hard facing process is performed by using the finite element method. The simulations were executed on the open source Salome platform using the open source finite element solver Code Aster. The Gaussian double ellipsoid was selected in order to enable greater possibilities for the calculation of the moving heat source. The numerical results were compared with available experimental results.

Keywords: *welding simulations; transient heat conduction; moving heat source;*

Introduction

In the case of numerical analysis of the temperature field, the hard facing process belongs to a group of welding problems which are usually simulated as three-dimensional transient heat transfer problems, and also nonlinear if the thermal properties of the material are treated as temperature dependent. The most important issue of numerical model is the moving heat source.

The way in which the process is simulated numerically is a great simplification of the real process. The model is most often a plate with the heat source moving along one axis with constant velocity. Calculations are straightforward but, due to the size of the plate for example, they can be demanding in computation time and memory, and still do not give completely reliable results. For a long time numerous experimental and numerical studies have been dealing with different aspects of the problem, [1-5]. There is a wide range of functions for the heat source implementation, but the most accepted is certainly the double ellipsoidal heat source, [6]. Recently, those studies dealing with a reliability of both, experimental and numerical results have become significant, [7-11].

The model for this numerical analysis was a plate that was chosen from a very extensive experimental analysis of the hard facing process given in [12]. During selection priority was given to a group of measurements that provide most information for the setup of

*Corresponding author, e-mail: vlazic1@sbb.rs