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CONTENTS

INSTITUTE OF WELDING

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Summaries of the articles

Z. Mirski, J. Rabiega, Z. Fałek – Welding of steel road bridges in the past and nowadays

DOI: 10.17729/ebis.2019.6/1

The paper describes history of the first welded bridge in Europe, located over Słudwia River in Maurzyce near Łowicz, as well as design assumptions of welded connections and current state of welds made during post-war repairs. For comparison, modern welded connections of a footbridge alogside Szczytnicki Bridge in Wrocław are also presented. Information on possible repairs of the construction of old riveted bridges by welding was provided.

M. Kapler, J. Nowacki, A. Sajek – Possibilities of using production testing of arc welding of pins in qualifying operators

DOI: 10.17729/ebis.2019.6/2

The analysis of the normative terms and conditions concerning qualification testing of stud welding operators was made. The special attention was paid to the eligibility of employees performing welds of shear connectors using drawn-arc and ceramic ferrules. The authors underlined the risk of technical standards misinterpretation and its financial consequences. The focus of attention were also popular approaches of examination bodies in this field. Finally, it was pointed out that there exists effective in law way of production personnel qualification on the basis of production test.

L. Tuz, K. Sulikowski – Evaluation of laser welding of high strength steel with 1100 MPa yield strength

DOI: 10.17729/ebis.2019.6/3

The article presents selected results of technological tests of welding high-strength steel (guaranteed yield strength of 1100 MPa) using a robotic laser beam welding station. The joints were subjected to visual, macroscopic and microscopic tests as well as hardness measurements. The obtained results indicate the presence of martensitic-bainitic structure in the cross section of the welded joint and the occurrence of a narrow zone of low hardness (softening zone).

A. Klimpel – Overview of laser welding techniques

DOI: 10.17729/ebis.2019.6/4

Laser welding is a highly efficient processing technology, widely applied to the manufacturing industry. This paper makes an overview of basic laser welding techniques: key-hole, melt-in (conduction welds), hybrid (laser + GMA) and laser + consumables and describes their industrial applications. Benefits and negatives of laser welding processes are analyzed and typical laser weld defects and the possibility of laser welding quality monitoring are described.

R. Krawczyk – Analysis of indications in penetration tests of welded joints

DOI: 10.17729/ebis.2019.6/5

The article presents the analysis of indications detected in penetration tests of welded joints. The analysis used was butt welded joints made of aluminium and steel. The study involved various penetration and development phase durations. A detailed assessment of the size of the indications was carried out on the basis of the registered course of the test in a continuous system.

H. Danielewski, A. Skrzypczyk, W. Zowczak, P. Furmańczyk, D. Gontarski – Numerical modeling of bifocal laser welding of low alloy construction steel

DOI: 10.17729/ebis.2019.6/6

The article presents the possibilities of numerical modeling of the laser welding process. In

laser welding, the concentrated photons beam effect in high surface power density and leads to the melting and even evaporation partial of metals. The metal vapors ionize and form a keyhole. Laser welding process in order to high linear power density allows for create narrow and deep welds. However this welding methods requires preparation of components edges. It is possible to overcome this requirement by defocusing the laser beam, nevertheless it effect on power density volume. An alternative is to use optical systems to divide the beam. In CO_2 gas lasers, the bisection of the laser beam was carried out by a multi-faceted parabolic mirror. For modeling of welding process an analytical and numerical methods can be used. Analytical solutions give an approximation results and omitted many physics phenomena occurring during welding process. Numerical solutions given more accurate results of the welding process, it is possible to modify the heat sources geometry to simulating keyhole effect of bifocal welding system. The paper presents the results of numerical simulation of a keyhole laser welding process for a bifocal optic system. The results of the numerical simulation were verified experimentally by test joints with the parameters developed in numerical simulations. Both the shape of the welds and the hardness distribution obtained in the cross section of the S235JR low-alloyed structural steel joint were verified in order to verify numerical model adjustment.

A. Sawicki – Mathematical differential and integral models in macromodeling of electric arc using voltage and current controlled sources. Part 1. Variants of electric arc macromodels given by different forms of differential or integral equations

DOI: *10.17729/ebis.2019.6/7*

The justification for creating mathematical models of electric arc in differential and integral forms is given. Simple variants of classic mathematical arc models with indefinite or unreduced ignition voltage are considered, as well as variants of modified mathematical arc models with specified or reduced ignition voltage. In addition, hybrid mathematical models of electric arc in differential and integral forms are considered. They are also presented in an unrationalized form (with parameters dependent on the arc current) and in a rationalized form (with parameters dependent on the column conductance). The effectiveness of various macromodels was checked by simulating processes in circuits with electric arcs.

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