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Recent Advances in Mechanical Engineering Applications

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Proceedings of the 4th European Conference of Mechanical Engineering (ECME' 13)

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Recent Advances in Mechanical Engineering Series | 8

ISSN: 2227-4596
ISBN: 978-960-474-345-2

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Published by WSEAS Press
www.wseas.org

All papers of the present volume were peer reviewed by no less that two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.
See also: http://www.worldses.org/review/index.html

ISSN: 2227-4596
ISBN: 978-960-474-345-2

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Plenary Lecture 1

Simulation of Thermo-Mechanical Effects Induced by Submerged Double-Arc Welding Process in Pipelines

Professor Elena Scutelnicu
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Abstract: Submerged arc welding is the most applicable and productive procedure when thick sections have to be welded. Welding thick material involves large amount of filler material and, frequently, long length of welds. The process is used for the welding of low carbon steels, stainless steels, nickel-based alloys or surfacing applications. Due to the high value of deposition rate, excellent fusion, deep penetration, uniform and aesthetic appearance of welding layers, submerged arc welding is widely applied in manufacturing of pressure vessels, pipelines, ships and offshore structures. Although the process itself is characterized by a high level of productivity, the actual trends in the process development are looking for further growth of the deposition rate. The process has continuously developed and, presently, can be performed in various ways, from the simplest process with a single wire and DC power to more advanced twin-wire and tandem welding variants. A particular case is that of pipelines used in the transport infrastructure of refined petroleum products. The longitudinal welded pipelines are, most of the time, performed by submerged arc welding procedure with multi-arcs while high productivity is achieved. Still, the quality criterion has to be the highest priority in achievement of safe welded joints. Simulation of the manufacturing process is useful in designing the optimum technology and choosing the best welding conditions which ensure safe and quality welded joints. Finite element analysis programs have evolved and weaknesses in joining technology designing can be detected, even before testing the welded joints. Thermal, mechanical and structural effects - induced by the welding process on the base materials - are rigorously predicted. The present investigation focuses on the evaluation of heat transfer and von Mises stress distribution in longitudinal welded pipeline performed by multi-pass submerged double arc welding. A three-dimensional finite element model has been developed to simulate the coupled thermal-mechanical fields. Transient and quasy-stationary distributions and evolution of temperature field, equivalent stress and plastic strain have been analysed and discussed in detail.

Brief Biography of the Speaker: Elena Scutelnicu is Professor at Department of Manufacturing Engineering, Faculty of Mechanical Engineering from “Dunarea de Jos” University of Galati, Romania. She obtained PhD degree in 2003 in Industrial Engineering field and became full professor in 2007. Elena Scutelnicu was the head of Robotics and Welding Department (2007-2009), director of Research Department within the Centre for Advanced Research in Welding from Faculty of Mechanical Engineering (2006-2012) and since 2009 is vice-dean of Mechanical Engineering Faculty. She is expert of the International Institute of Welding - IIW and coordinator of Industrial Engineering Doctoral program within Engineering Doctoral School of "Dunarea de Jos" University of Galati. Her contribution, as author or co-author, includes 10 books and 164 articles published in the fields of Welding Process FEA & Simulation, Heat Transfer in Welded Joints and Materials Behaviour during Welding Process. The most representative papers in the welding field are published in the international peer-reviewed journals and proceedings of international conferences organized by International Institute of Welding – IIW and European Welding Federation - EWF in Austria, Denmark, Russia, Israel, Japan, Singapore, Spain, USA, Croatia, Republic Czech, Turkey etc. Elena Scutelnicu was involved, as manager or member in the research team, in 20 national R&D grants and 12 grants funded by EU. She obtained 8 awards of the Romanian Ministry of Education and Research for scientific contribution (2007, 2008, 2009, 2010), Diploma of Romanian Welding Society for meritorious activity (2006).

ISBN: 978-960-474-345-2

Plenary Lecture 2

Impact and Crashworthiness of Composite Structures: Delamination Failure

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Abstract: Crashworthiness of fibre-reinforced polymer (FRP) composite materials and structures is classified based on their deformation, failure and absorption of the crushing energy in a controllable behaviour. Energy absorption is therefore considered as an important factor in design of composite structures. Despite extensive investigations on the energy absorbing capabilities of fibre reinforced polymer (FRP) composite absorbers under axial loading, the off-axis crashworthy behaviour of composite absorbers remains unknown. The interlaminar crack propagation (delamination failure) is known as one of the factors which affect the progressive crushing modes and energy absorption capability of laminated FRP composite tubular structures.

Brief Biography of the Speaker: He was awarded a PhD in Aerospace Engineering in 2009 following successful completion of his MSc with Distinction in Automotive Engineering from Kingston University, London. Upon completion of his PhD degree, he was appointed as a Lecturer in Mechanical Engineering at Kingston University London. In 2011 he received his fast-track early promotion to Senior Lecturer position in Composite Materials in the school of Aerospace and Aircraft Engineering. His main research areas are focused on the damage tolerance and failure modes in the laminated composite structures under various loading conditions such as buckling, post-buckling, fatigue, impact and crash. He experimentally, analytically and numerically has demonstrated the effect of the interlaminar crack propagation in Mode-I, Mode-II and Mixed Mode I/II on the progressive crushing modes and energy absorption capability of laminated FRP composite sub-structures. Since his academic appointment in 2009 he has supervised more than 25 research projects on Composite Materials. He has regularly published the outcomes of his research in more than 40 major international peer-reviewed multidisciplinary scientific journals and conferences. He is also member of EPSRC Peer Review College and acts as member of editorial board and international scientific committees of international journals and conferences.

ISBN: 978-960-474-345-2

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