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# A Global Approach on Residual Strains and Stresses State Analysis of Metal Structures

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## ABSTRACT

Theoretical and experimental assessment of the residual stresses and strains state produced by welding processes is a very important problem, because these stresses may be added to those produced by the exterior loads, usually reducing the structure resistance, and the deformations change the shape and the dimensions of the structure. The problem becomes more important when the dimensions and the complexity of welded structure increase, and its importance is obvious very high: ship body, metallurgical metal structures, chemical equipment etc.

Since the theoretical and experimental methods of stresses and strain state appeared in these kinds of structures due to external loads are quite common, a theoretical and, mainly, an experimental methodology for welding residual stresses analysis in case of big and complex welded structures is useful to be established.

In this order, the paper presents the main stages and methods for experimental assessment of after-welding residual strains and stresses state. After the problem presentation, its necessity and importance and the main appropriate methods for residual state of stresses and strains determination, in case of these structures are presented.

The main stages in the research approach follows: structure description, architecture and welding technology main components, theoretical quantitative and qualitative assessment of stresses and strains state, appropriate experimental investigation methods analysis (critical analysis, variants, details, main experimental method establishment), requested laboratory testing and verification methodologies nomination (including equipment performances). Team experience and training, the level of precision possible to be achieved versus the requested one, stages and tasks etc. are important components of the research project's handbook.

A special stage of this approach includes the laboratory tests on models: reduced-size models or partial models. In both cases there are specific features and problems to face. Special features must be assured to the partial model in order to create similar rigidity conditions etc.

The final experimental stage contents the tests on the real structure, with its entire specific problems related to the construction dimensions, its location, work on exterior etc. These are obviously followed by data analysis, interpretation and conclusions.

This global approach was implemented in a *3-year research programme on the ships' plane units* developed by the Robotics and Welding Department, Shipbuilding Department-Dunarea de Jos University of Galati and The Shipbuilding Research Institute-Galati, ROMANIA. During the stages presentation, practical examples of this research are presented, as too.

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