

**The Second International Symposium on
Risk Analysis and Safety of Complex
Structures and Components
IRAS 2023**

Belgrade, Serbia, 02-04 April 2023

IRAS23

BOOK OF ABSTRACTS

*Proceedings of the Second International
Symposium on Risk analysis and Safety of
Complex Structures and Components*

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Title

PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON RISK ANALYSIS AND SAFETY OF COMPLEX STRUCTURES AND COMPONENTS - IRAS 2023

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ISBN

978-86-900686-1-6

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Experimental Determination of J_{IC} for a HSLA Steel Welded Joint

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Abstract

Most serious weldment failures have catastrophic consequences in terms of damage to other equipment, loss of production, and risks to worker health and safety. For the above reasons, there is a tendency to find the line between safety and disaster, and this requires a guarantee of the integrity of the welded structure even if a crack is present.

The structural and mechanical heterogeneity of a welded joint affects its resistance to cracking in both the elastic and plastic regions. Therefore, it is important to define the test method and the position of the fatigue crack. The behavior of an elasto-plastic material, during stable crack growth can be described by the $J-\Delta a$ diagram. As the crack propagates, a point on the curve is defined, which represents the critical value of the J -integral. The aim of this experiment is to determine J_{IC} value and the procedure is reflected in the determination of the R curve, i.e. the $J-\Delta a$ curve, which consists of the value of the J integral for uniform crack increments Δa . In this paper, two SEN(B) specimens with the fatigue crack in the parent material (PM) and weld metal (WM) were tested according to standard ASTM E1820 at room temperature (RT) as well as three specimens with the fatigue crack in the weld metal (WM) at RT, -20 0C, -30 0C.

Keywords: J-integral; J-R curve; HSLA steel; welded joints