
# BOOK OF ABSTRACTS

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

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# Residual life estimation of damaged structures exposed to high pressures and temperatures

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## Abstract

This paper deals with the damage growth in High-Pressure Turbine (HPT) cooling holes of the case assembly made of Inconel 718. Several marks (cuts) were made on cooling holes into parent material during the service due to the non-skilled use of Electrical Discharge Machining (EDM) in the workshop. After a certain time, the case assembly returned to the workshop with all EDM marks cracked. Since HPT case assembly is not repairable and the only method for fixing this issue is its replacement with the new or used one (which might be pretty expensive), it was decided to use numerical analysis to estimate Paris coefficients for used Inconel 718, since the number of cycles and crack growth from the initial position were known, based on data obtained from the workshop. Firstly, finite element method (FEM) based numerical analysis was conducted in order to simulate crack propagation to match the one observed in the workshop, and then a multi-objective genetic algorithm – implemented thru response surface optimization – was used to obtain required Paris coefficients. The objectives of this optimization were the crack length and the corresponding number of cycles of crack growth. Obtained Paris coefficients were then used to estimate the residual life of HPT case assembly.

**Keywords:** high-pressure turbine; Inconel 718; Electrical Discharge Machining; Paris coefficients