Determining the Likelihood of a Favourable Finite Element Analysis

Case study

EASL, from their wide experience of fracture codes and assessments, were approached by EDF for their expertise. EASL were able to recommend the use of the RSE-M procedure. With the adaptation of proven assessment tools, EASL were able to provide a cost effective and timely result which was then used as the basis for making an informed decision regarding the direction to take a structural integrity argument.

Working in partnership

Within an AGR nuclear power station there are a number of components that exist for which the consequence of failure would be very severe. One such component, a superheater outlet header weld, has an 'Incredibility of Failure' safety classification. One leg of the safety case is the consideration of defects.

Previously, the R6 defect assessment procedure had been used to calculate the limiting size of a defect that could exist in the structure without fracture. The level of conservatism within the R6 code can be quite considerable due to the broad scope of components and conditions that it is designed to assess.

As such, the limiting defect sizes calculated were relatively small, and the defects postulated in the safe life assessment were predicted to grow beyond the limiting size.

To reduce the amount of conservatism in the assessment, a cracked body non-linear finite element analysis (FEA) can be carried out. This is an expensive option and can take a considerable amount of time to complete.

A previous FEA had been carried out which considered a fully extended defect which produced results that weren't conducive to demonstrating a safe life. This assessment was overly conservative because in reality the geometry of a defect would be closer to a semi-elliptical shape.

The project

Given the amount of time and money it would take to carry out an FEA, the client wanted assurance that the results produced would be favourable.

The answer, in this instance, was to assess the component using the RSE-M procedure and use the results from this as an aid to judgement. EASL have recently been involved with the review of the fracture assessment code to be used in the design substantiation of nuclear new build projects. The approved code is the French procedure RSE-M following the 'UK methodology'.

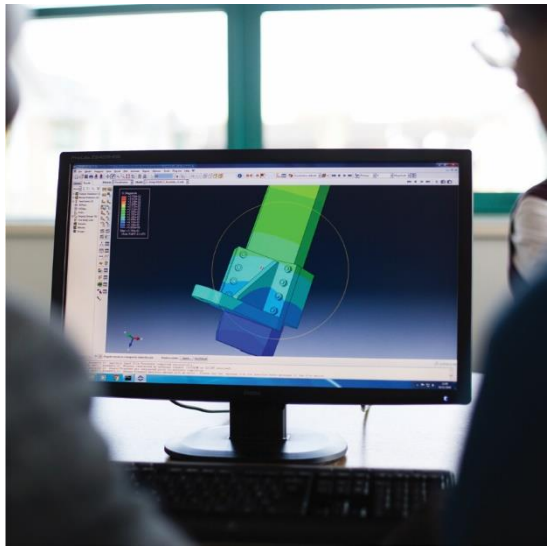
RSE-M has a reputation for accurately calculating the fracture parameter J.

The first stage of this work was to calculate J estimations for a fully circumferential defect to be compared with the FEA J values. The close comparison gave confidence in the accuracy of the RSE-M J-integral estimations.

The second stage was to calculate the J estimation for a semi-elliptical defect which could then be used as an approximation of the FEA J value.

Given the findings of this work, the RSE-M J estimation gave confidence that the FEA J value for a semi-elliptical defect would give a favourable result.

This small task cost around £10,000. The potential cost of the FEA for a semi-elliptical defect is likely to be in excess of £100,000. This is a prime example of how EASL can provide value for money to its clients.



EASL provided a cost-effective solution, which saved the client from having potential 10 times higher expenses.

If you would like to find out more or discuss how EASL can help your business, please get in touch.

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