



Fatigue

One of the many aspects of evaluation of structures, systems and components we can provide our expertise for is fatigue. With over 250 man years of experience analysing and assessing mechanical processes across a wide range of industries, we can deliver insight and clarity to clients for a trustworthy assessment of fatigue effects.

Whether it's for civil nuclear, power generation, defence, oil or gas, over time fatigue can take an effect leading to damage, fracture, or worse failure. If left unchecked, this can lead to unexpected expensive remedial work, unplanned outages and in extreme cases injury of staff. EASL can supply a cost-effective and pragmatic assessment, providing an independent service to base decisions on.

What is Fatigue?

Fatigue is a damage mechanism which often leads to fracture of components in service where they are subject to cyclic loading. Fatigue cracks are initiated from points of high stress concentration on the surface of components.

Cyclic loading causes the cracks to propagate through the remaining cross section until it reaches a critical size when fast-fracture results in failure. Fatigue failures often occur under cyclic loading below the elastic limit of the material. Unlike static loads, where the absolute value of stress is considered, the stress range between plant states is considered in fatigue assessments.

The stress ranges under cyclic loading can be obtained using the analytical or numerical analysis methods described here. The acceptance criteria for fatigue assessments is by means of fatigue endurance data specific to the material under consideration.

The data is often supplied in the form as stress vs cycles to failure curve, commonly referred to as "S-N curve". These are obtained from cyclic tests performed on laboratory specimens. The calculated stress range value can be read from the S-N curve to obtain the number of cycles to failure or vice-versa.

The aim is to demonstrate that margin exists between the number of cycles to failure and the number of design cycles for the component. It is important to note that in this context use of the term "failure" indicates initiation of a fatigue crack and not necessarily failure of the component.

Fatigue behaviour can be affected by interactions with other conditions in the component, such as creep and environmental effects. More details on creep-fatigue can be found below in our related services. Environmentally assisted fatigue has been the subject of recent world-wide research and development to support changes to the ASME and RCC-M design codes.

The main focus for this phenomenon has been for light water reactors, where the primary circuit coolant has been shown to reduce the fatigue endurance of the material and increase the fatigue crack propagation rate.

Although both creep and environmental effects alter the response of the material, and can be complex to model and analyse, the aim of the fatigue assessment is unchanged – that is to compare a stress range against an allowable value based on the number of design cycles for the component.

EASL's Fatigue Services

EASL offer solutions for analysing and assessing fatigue behaviour of plant and components to ensure that they meet the design requirements whilst in service. We have extensive experience in the design code requirements for fatigue assessments and are actively working with organisations conducting worldwide research and development and developing methods to treat environmentally assisted fatigue within the RCC-M code.



Our work is a solutions-based approach, meaning that we take a pragmatic approach to client's problems and potential issues, looking at real world conditions specific to the working conditions. Findings from fatigue analysis and assessment can contribute towards the development of safety cases, design code and can help to provide information for clients to save time and costs by adding fatigue related decisions to existing planned maintenance work.

If you'd like to find out more about our previous work, take a look below at our case studies. If you'd like to find out more about our related services, take a look below at our solutions and other services. To see how EASL can help with your fatigue needs, get in touch through our contact section.

Related Services

- Creep Fatigue Crack Growth
- Creep Fatigue Initiation Assessment
- Design