## Why should I use fatigue analysis software?

Fatigue failures are costly and can result in accidents - or at least, expensive product recalls and warranty claims. Traditional fatigue analysis methods are time-consuming and unreliable and test programs can be lengthy and open-ended.

## Is all fatigue software the same?

No. Not all fatigue analysis software is as accurate as fe-safe. And getting the wrong result is arguably worse than not doing a fatigue analysis at all. Re-designing a component on the back of an incorrect analysis result is costly and time-consuming and does not lead to production of the lightest and most durable product. fe-safe gives fast, accurate results *regardless of the complexity of the analysis*. It does this by using advanced multiaxial strain-based fatigue methods. Users consistently report excellent correlation with test results.

## Is fe-safe right for my industry?

Yes - providing you conduct finite element analysis using one of the main FEA packages and you are concerned with the durability of products or components made from metal or elastomers. fe-safe includes a comprehensive materials database and handles weld fatigue - including spot welds - vibration, high temperature and creep fatigue.

## Do I have to choose between speed and accuracy?

No. Unique nodal elimination methods in fe-safe ensure that there is no trade-off between getting your result quickly and getting the correct result - regardless of the complexity of the analysis. Users consistently report excellent correlation with test results.

## Do I need to be a fatigue expert?

No, you can leave that to us. There are factors which cannot be ignored if results are to be trusted. However, because fe-safe is technically advanced, it is configured to take into account many variables which will affect the accuracy of your results automatically.

## Can I get fast, accurate results for my simple analyses?

Yes. fe-safe is not just for the complex stuff. However, even a simple analysis may not be as straightforward as you have been led to believe. As fatigue experts, we know that there are variables which cannot be disregarded if you want a truly accurate result. Because fe-safe is technically advanced and designed by fatigue experts, it automatically takes into account important factors that can still make a dramatic difference to the accuracy of your results. The results from your 'simple' analysis are fast and accurate.

## Can I get fast, accurate results for my complex analyses?

Yes. Highly efficient and advanced coding plus parallel and distributed processing allow fe-safe to analyze large finite element models accurately and report results quickly. Assemblies of different parts, surface finishes and materials can be analyzed in a single run and fe-safe automatically changes the method of analysis as it moves from one material to another so you are always using the most appropriate algorithm. Also, fe-safe is highly configurable for the advanced user.

## Are these the correct fatigue 'hot spots'?

If these are not identified correctly, you end up adding material in the wrong places, which results in a heavier component that still isn't designed for optimum durability! Advanced, multiaxial algorithms are the core of fe-safe and are backed up by sound fatigue theory. fe-safe shows how much the design is over-strength or under-strength at each node, giving you the confidence that you are adding material only where necessary to achieve optimum fatigue life.

## What is the fatigue life of this component?

Knowing when a part will break due to fatigue failure is invaluable information when it comes to managing test and maintenance programs. With fe-safe as part of your design and analysis workflow, you will see excellent correlation between your test and analysis results - within a single user interface. This in turn reduces prototype test times and gives you the confidence that your product designs will pass their test schedules as "right first time".

fe-safe uses advanced critical plane multiaxial fatigue with in-built plasticity modeling to post-process results from an elastic FEA. Results can be displayed as contour plots showing crack locations and fatigue lives.

## What is causing fatigue cracking?

fe-safe can provide detailed results for hot-spot areas or individual elements or nodes, time histories of calculated stresses and strains, fatigue cycle and damage histograms, Haigh and Smith plots and many other graphs in order to explain why the fatigue life is what it is.

## Will the cracks propagate?

fe-safe uses critical distance methods to check whether cracks will propagate. Allowing cracks to initiate but not propagate to failure may allow higher working stresses and lighter, more efficient designs.

## Where can material be saved? Where must extra material be added?

fe-safe calculates the allowable stresses or loads to achieve a specified service life. This is the factor of strength (FOS). fe-safe fully accounts for any changes in plasticity that may be caused by changes to loads or stresses. fe-safe shows how much the design is over-strength or understrength at each node. Results are displayed as contour plots.

## How reliable is this design?

The 'warranty claim' calculation combines variability in material strength and variability in loading to estimate the proportion of components un-cracked after any period of time in service. This can be used to achieve uniform reliability over different parts of an assembly. Factor of Strength (FOS) and Probability of Survival calculations can be combined with the initial fatigue life calculation in a single run. Together they show the interaction between design stress margins and component reliability.

## Which loads are causing fatigue damage?

fe-safe performs a load sensitivity analysis to show the effect of each applied load. This can be used to refine the design, and to design and validate an accelerated fatigue test. Once the critical and non-critical loads have been identified, test programs can be optimized and validated by removing unrepresentative tests.