ENGINEERING TRAINER

Comprehensive Guide to Fatigue

This metal-fatigue course covers fatigue mechanisms from material behavior and notch effects through local and nominal-stress methods, joints, variable-amplitude loading, residual stress, environmental effects and fracture mechanics. It also addresses testing, scatter, multiaxial fatigue, design choices and maintenance decisions. This self-paced online course includes video lectures and a completion certificate with PDH credits.

Buy This Course

Request a Quote or Invoice

ONLINE	SELF-PACED	1-YEAR ACCESS
14 MODULES	13 PDH	13 HOURS

TRUSTED BY ENGINEERING TEAMS WORLDWIDE

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What you'll learn

Did you know that the number of structural failures due to fatigue is much larger than due to static overload? Managing and preventing problems due to metal fatigue should be considered a key capability of a structural engineer. Safe operation of your structural asset is important to you, you want to avoid your structure collapsing. This course will give you a detailed overview of fatigue; practical advice and guidelines are given, and justified based on the theoretical background. After this course you will know exactly what fatigue is, what loads are causing fatigue, how you can control fatigue, how you can improve your design and which factors are good and bad for fatigue. With this knowledge you can determine a safe fatigue life for your structure. The course consists of 14 online courses based on video lectures. Participants also gain access to a technical archive of fatigue related articles by the instructor. All training content is provided through your EngineeringTrainer account.

Skills you'll gain

- ✓ have a fundamental understanding of high cycle fatigue, and how to interpret the fatigue calculation methods in industry standard codes.
- ✓ know how to identify fatigue critical locations, and are familiar with the analysis methods (both analytical and FEA) to predict the fatigue life.
- ✓ understand the limitations of fatigue life analysis and the effect of scatter.
- ✓ have seen how fatigue behaviour is impacted by the mean stress, the surface condition and surface treatment.
- ✓ understand how fatigue behaviour is impacted by the environment, such as temperature and corrosion.
- ✓ have seen the concepts for damage accumulation and combined fatigue loading.
- ✓ understand how to test structural components for fatigue.
- ✓ know the crack growth mechanism and can calculate the residual strength.

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About the instructor

Johannes Homan

Johannes Homan is a fatigue and damage-tolerance specialist with an aerospace-engineering background. After working at Fokker Aircraft, he founded Fatec Engineering in 1996 and also worked as a researcher and assistant professor at Delft University of Technology. His courses cover fatigue mechanisms, life analysis, testing and damage-tolerant design.

Who this course is for

- ✓ Stress engineers performing fatigue assessments
- ✓ Structural designers responsible for fatigue-sensitive details
- ✓ Test engineers planning or interpreting fatigue tests
- ✓ Lead engineers reviewing fatigue-analysis work
- ✓ Engineering managers responsible for fatigue-related design decisions

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Course content

Module 1 - What is Fatigue

- What is fatigue? Why is fatigue important?
- Fatigue mechanisms & phenomena

Module 2 - Fatigue of Materials

- Effect of materials
- Effect of mean stresses
- Type of loading

Module 3 - Effect of Notches

- Stress concentrations
- Notch sensitivity factor

Module 4 - Fatigue Analysis - Nominal Stress

- Introduction
- Fatigue predictions using nominal stresses
- Examples
- Safety Factors

Module 5 - Fatigue Analysis - Local Stress

- Fatigue prediction using local stresses
- Examples
- Fatigue prediction using FEA

Module 6 - Designing Against Fatigue

- Design process
- Accuracy of fatigue analyses
- Practical examples of good and bad design

Module 7 - Fatigue of Joints

- Fatigue of welded joints
- Fatigue analyses for welded joints
- Bolts loaded in tension
- Bolts & rivets loaded in shear

Module 8 - Variable Amplitude Loading

- Load spectra
- Cycle counting
- Damage accumulation

Module 9 - Residual stresses & Surface conditions

- Residual stresses
- Surface conditions

Module 10 - Environmental Effects

- Effect of temperature
- Corrosion & stress corrosion cracking (SSC)
- Corrosion fatigue
- Fretting

Module 11 - Linear Elastic Fracture Mechanics and Fatigue

- Stress Intensity Factors
- Crack growth under constant amplitude loading
- Crack growth under spectrum loading
- Residual strength
- Crack growth and residual strength analysis

Module 12 - Testing and Scatter

- Experimental approach
- Coupon testing through to full scale testing
- Quantification of scatter
- Scatter factors and coupling with safety factors

Module 13 - Multi-axial Fatigue

- Multi-axial stress states
- Fatigue mechanism under multi-axial stress state
- Proportional and non-proportional multi-axial stress states

Module 14 - Fatigue & Maintenance

- Maintenance policies in relation to fatigue
- Reactive and preventive maintenance