

Training Course

FAILURE ANALYSIS

OVERVIEW

This course provides details of the main principles of failure analysis. System failures often occur during or shortly after the product development phase where new technologies are often brought to market under high time pressure and with limited resources. Under such conditions it is important that proven methodology and tools are available to quickly assess and understand such failures.

Typically the root cause must be identified and solutions developed. A structured consideration of technical, organisational and economical aspects of the problem typically leads to effective recommendations. The topics covered in this seminar are illustrated using practical applications, with specific examples provided to clearly illustrate the concepts introduced.

TYPICAL PARTICIPANTS

- Engineers with a background in development, validation, quality and production of technical products. Team leaders, product managers and technical management staff.

MAIN SKILLS DEVELOPED

- Planning, management and execution of failure analysis activities
- Development of damage models for specific issues
- Effective application of specialised analysis methods
- Implementation of improvement measures

LOCATION

- Training centre at Uptime Engineering in Graz, or on location at customer premises

LANGUAGE

- English or German

DURATION

- 2 day training course

PRICE

- € 1500 for 2 days training at Uptime Engineering in Graz



COURSE STRUCTURE

DAY 1

Introduction

- Overview of failure analysis, economical aspects, potential and limitations
- State of the art, typical challenges in practice
- Definition of failure mechanisms according to standards such as VDI 3822
- Overview of methods and tools

Process for Failure Analysis

Collection of indicators

- Inspection of failed equipment, assemblies or components
- Indicators for mechanical, thermal, electro-chemical damage mechanisms
- Data on design and production
- Coverage of technical specifications and quality system
- Conformity of failed part with prescriptions
- Load history, boundary conditions, condition at failure

Statistical analysis of data

- Information content of failure statistics and service documentation
- Time evolution of failure rate, homogeneity of failures
- Lifetime simulation

Hypothesis development

- System analysis (fault tree analysis, cause-effect chain)
- Logic and reasoning: abduction, induction, deduction
- Methods of diagnosis
- Physics of Failure based models
- Design of critical experiments for exclusion of failure mode candidates

DAY 2

Assessment of load capacity

- Review of component design and technical specifications
- Assessment of manufacturing techniques based on process data and properties with variance
- Potential of materials analysis techniques
- Consideration of load capacity variation in prototype components
- Changes in properties caused by long term operation

Assessment of applied loading

- Failure mode related analysis of load conditions
- Effect of tolerance chains and duty cycle variations on load conditions
- Comparison of load history for operational fleets

Problem Solving

- Risk assessment and analysis of variants based on physics of failure methodology
- Process refinement for casting, heat treatment, hardening, welding, etc.
- Review of quality system and technical specification in view of failure mechanism
- Derivation of recommendations, preventative maintenance, field recall activities

Continuous Process Improvement

- Systematic know-how documentation
- Design and usage of databases for load spectra, maintenance and failure cases
- Closed loop between design, development, production and service
- Transfer from implicit to explicit knowledge
- Interface-management: manufacturer-supplier

INCLUDED EXERCISES

- Inspection of a failed part and derivation of an action plan for clarification of open points
- Weibull-Analysis of a series failure case
- Demonstration of the procedure for developing a part specification
- Cause-effect chain for a failed part, selection of a damage model
- Applicability of test methods to prototype parts
- Identification of critical load spectrum via damage calculation
- Action plan for recall activity according to time evolution of failure evidence
- Hand-over process for a component between development and production
- Architecture of a failure database