Appendix 1

About the Course

The prevention of failures of engineering structures is an ambitious task and a real challenge for all persons involved in manufacturing, design and quality assurance of technical components. There is no doubt that the reputation and the success of a company is finally determined by the quality and reliability of their products.

In this context failure analysis plays an overwhelming role because a consequent and correct failure analysis is the essential basis of prevention of future failures and the continuous improvement of the product quality. Learning from mistakes means in the last consequence learning from failures.

The distribution of the techniques of failure investigation, the demonstration of the microscopic and macroscopic characteristics of the different types of failures, the evaluation of the causes of failures and profound proposals for measures of failure prevention is an important task for all persons involved in planning, design, manufacturing and operation of structures.

The course on failure analysis is designed for staff of teaching and research institutions on one side and engineers of industry concerned with construction, numerical and experimental stress analysis, materials and manufacturing as well as testing, quality control and surveillance.

The content of the course covers the fundamental principles of the safety of structures, the main causes for failures under mechanical, thermal and chemical loading and the methods applied in failure investigation as well as the tools of failure prevention.

Failure analysis is often treated only from the point of view of material and manufacturing influence. The specific concept of this course is that besides material and manufacturing aspects the role of design as well as the reaction of an imperfect structure to the imposed loads are included. This leads to aspects like the safety relevance of toughness and the application of fracture mechanics to components with crack like defects. Furthermore, an outstanding characteristic of the course is the treatment of numerous practical failures in case studies.

The conductor of the course has about 50 years of intense experience in the safety of structures in general and failure investigation in specific.

Appendix 2

Course Lucian Blaga University of Sibiu (Romania)
May 2019

Failure Investigation, Interpretation and Prevention in Automotive Engineering

Prof. Dr.-Ing. Lothar Issler

Steinbeis Transfer Centre BWF „Integrity of Structures, Material and Joining Technology“ at University of Applied Sciences, Esslingen (Germany)

1. Introduction
1.1 Significance of Failure Analysis
1.2 Historical Failures
1.3 Typical Failures of Car Structures
1.4 Definition of a Failure
1.5 Classification of Failures

2. Main Reasons for Failures
2.1 Statistical Aspects
2.2 Material
2.3 Manufacturing
2.4 Design
2.5 Operation
2.6 Human Deficiencies
2.7 Case Study 1: Failures of Welded Structures

3. Fundamentals of Design of Structures
3.1 Stress Categories
3.2 Advanced Design Concepts
3.3 Safety Relevance of Component Toughness
3.4 Case Study 2: Failure of a Container Crane

4. Basic Rules for Failure Prevention
4.1 Basic Principles
4.2 Material Optimization
4.3 Manufacturing Principles
4.4 Design Principles
4.5 Operation Rules

5. Methodology of Failure Investigation

5.1 Basic Rules
5.2 Sequence of a Failure Investigation
5.3 Fractography
5.4 Methods for Material Investigation
5.5 Stress Analysis Methods
5.6 Application of Design Concepts

5.7 Consequences and Report
5.8 Case Study 3: Failure of a Screw

6. Failures due to Mechanical Loading
6.1 Classification
6.2 Brittle Fracture
6.3 Ductile Failures
6.4 Fatigue Failures
6.5 Case Study 4: Fatigue Failure of a Hydraulic Cylinder

7. Failures due to Thermal Loading
7.1 Classification
7.2 Temperature Influence on Microstructure
7.3 Creep Failures
7.4 Thermal Mechanical Fatigue
7.5 Prevention of Thermal Failures
7.6 Case Study 5: Thermal Mechanical Fatigue Failure

8. Failures due to Chemical Loading
8.1 Fundamentals of Corrosion
8.2 Corrosion Failures without Mechanical Loading
8.3 Corrosion Failures with Mechanical Loading
8.4 Prevention of Corrosion Failures
8.5 Case Study 6: Corrosion Failure

9. Summary and Final Discussion

Appendix 3

Lothar Issler
Prof. Dr.-Ing.

Born 1943 in Schwäbisch Gmünd (Germany)

1953 - 1962
Parler Gymnasium Schwäbisch Gmünd

1962/1963
Practical Training Zahnradfabrik AG Schwäbisch Gmünd

1963 - 1969
Study Mechanical Engineering
University of Stuttgart

1969 - 1974
Scientific Assistent
Institute for Material Science, Strength of Material and Material Testing
University of Stuttgart

1974 Ph.D.
Fatigue of Metallic Materials under Out of Phase Loading

1974 - 1981
Material Testing Institute Stuttgart (MPA)
Research Integrity of Structures for Light Water Reactors

1981 - 2008
Professor for Strength of Materials and Joining Technology
University of Applied Sciences Esslingen
Department Automotive Engineering

2009
August Wöhler-Award of DVM for Outstanding Contributions in the Field of Material Testing and Fatigue

2008 - 2019
Lecture Failure Analysis in Automotive Engineering
Master-Course University of Applied Sciences Esslingen

2010 - 2019
Lecture Fatigue of Structures under Variable Amplitude Loading
Master Course Department of Civil Engineering
University of Applied Sciences Biberach

2001 - 2018
Director Steinbeis-Transfer Centre BWF
„Integrity of Components, Material and Joining Technology“
About 4000 Contracts with Small, Medium and Large Scale Industries
International Collaboration with Universities, Institutes and Industries in Argentina, India, China and South Africa.