Seminar on Design of Welded Components against Fatigue

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Besides corrosion and wear, fatigue is responsible for about 75% of all failures of welded structures. The fatigue process is an interaction of materials, weld imperfections, design, shape of the component and loading. The seminar will clarify the different influences and make modern design codes understandable. The International Institute of Welding has finalized the updated version of its fatigue design recommendations, which are based on the last developments in science and technology. These recommendations haven been developed under the chair of the speaker.

Preliminary Remarks

Failure modes, Brittle fracture

1. Basics

1.1 Definitions and terminology
1.2 Fatigue diagrams
1.3 Low cycle fatigue, endurance, fatigue limit, ultra high cycle fatigue
1.4 Scatter of data

2. Effects and Influences

2.1 Materials
2.2 Residual stresses and R-value
2.3 Notches, surface and size effects
2.4 Corrosion
2.5 Temperature

3. Analysis of Fatigue Loaded Components

3.1 Elements of an analysis
3.2 Methods of analyses
- 3.2.1 Nominal stress method
- 3.2.2 Structural hot-spot stress method
  - 3.2.2.1 Basic ideas
  - 3.2.2.1 Standard procedure for tubular structures, structural steelwork, pressure vessels, ships, off-shore structures etc.
  - 3.2.2.3 New methods as e.g. stress separation, Dong, Xiao-Yamada etc.
- 3.2.3 Effective notch stress method
- 3.2.4 Fracture mechanics method
  - 3.2.4.1 Basic considerations
  - 3.2.4.2 Application to fatigue of welded structures
- 3.2.5 Component testing method

3.3 Post weld treatments
3.4 Weld imperfections
- 3.4.1 Types of weld imperfections and related effects
- 3.4.2 Assessment of weld imperfections
- 3.4.3 ISO 5817, BS 7910, advantages and drawbacks

4. Cumulative Damage

4.1 Palmgren-Miner Rule
4.2 Safety considerations

5. Design Codes

4.1 IIW recommendations
4.2 Other codes

6. Case Studies