

Internationell svetskonstruktör, IWSD - Kursprogram

Module 6: DESIGN FOR PURPOSE OF WELDED STRUCTURES

Modul 6: "Anpassad" utformning av svetsade konstruktioner

6.1 Introduction to design for purpose concepts for welded structures, 3 tim

Objective:

The students will be introduced to the basics of the "design for purpose" strategy for welded structures

Scope:

Alternate structure solutions

Assessment of weld importance in terms of loading

Definition of weld quality for different purposes

Expected result at comprehensive level:

Explain the roles and priority of welds within a structure.

Explain the importance of various structural solutions for fatigue and static strength of a welded joint.

Review of possible weld defect types and identify significance or lack of significance for strength.

Review alternatives for improving the fatigue strength of a structural detail.

Illustrate good and bad examples of weld specification.

6.2 Improved design of statically loaded joints, 2 tim

Objective:

The students will understand what are essential items concerning improved design of statically loaded joints

Scope:

Flow of forces in welded joints

Weld start / stop positions

Slot and plug welds

Deformation capacity of a weld

Expected result at comprehensive level:

Illustrate the effect of statically loaded welds on a flexible foundation.

Review deformation capacity for statically loaded welds and illustrate good and bad design examples.

Compute optimal geometry for a welded attachment.

6.3 Improved design of fatigue loaded joints, 8 tim

Objective:

The students will understand how the fatigue life will depend on the different parameters and how these parameters can be control in design and manufacturing phases of production

Scope:

Nominal stress

Structural stress

Weld defects

Notch stress

Welds starts / stops

Root defects

Expected result at comprehensive level:

Review principals for weld location for improved fatigue strength.

Illustrate importance of reducing the structural stress concentration.

Explain the importance of weld misalignment in fatigue design.

Explain the importance of weld toe shape for fatigue.

Review importance of weld start / stop positions.

Compute fatigue strength of cruciform joint based on IIW recommendations.

6.4 Post- weld treatment methods for welded structures, 4 tim

Objective:

The students will understand the theoretical background, advantages and disadvantages of post-weld treatment methods. They will be acquainted with the practical aspects for executing the methods and inspection requirements. Reference document should be IIW publication XIII-1815-00 "IIW recommendations on post-weld improvement of steel and aluminium structures".

Scope:

TIG dressing
Grinding
Needle peening
Hammer peening
Quality control
Fatigue strength improvement

Expected result at comprehensive level:

Review common methods for post-weld treatment for welded joints.
Explain procedures and quality control procedure associated with common treatment methods.
Explain benefits and limitations of the various methods in terms of fatigue strength.

6.5 Design considerations for manual and automated welding processes, 2,5 tim

Objective:

The students will understand the design requirements and challenges involved in automated welding processes

Scope:

Weld angle and position
Interference
Seam tracking
Joint selection

Expected result at comprehensive level:

Review examples of both good and bad design with respect to manufacturability.
Explain sources of interference during welding and how these can be avoided in design.
Explain design alternatives that are better suited for automated weld processes.

6.6 Numerical methods and fatigue design, 4 tim

Objective:

The students will be introduced to the use of numerical analyses methods in the fatigue design of welded structures

Scope:

Finite element analysis
Nominal stress approach
Structural stress approach
Notch stress approach
Linear elastic fracture mechanics
Overview of fatigue numerical methods in a relevant design guidance document, e.g., IIW Doc. XIII-1965-03/XV-1127-03 "Recommendations for fatigue design of welded joints and components"

Expected result at comprehensive level:

Explain principals of proper FE meshing for fatigue analysis based on structural stresses.
Explain principals of proper FE meshing for fatigue analysis based on local notch stresses.
Review simple tools for fracture mechanics crack growth simulations.

6.7 Laboratory testing, 1,5 tim

Objective:

The students will have a general background on the role of laboratory testing and its role in research, development and design

Scope:

Fatigue testing methods
Quasi-static testing methods
Evaluation of laboratory failures
Methods for data analysis

Expected result at comprehensive level:

Explain the background of design curves based on fatigue testing.
Review of relevant documents and standards for laboratory testing and data analysis. For example:

- IIW XIII-1516-93 Fatigue testing of welded components;
- IIW XIII-1871-01 Large scale testing of welded components;
- XIII-WG1-114-03 Best practice guide on statistical analysis of fatigue data.