MU244:
Introduction to Stress Analysis
Training Description:

Ensuring your plant’s piping systems adhere to international codes and standards plays an integral role in keeping your plant operational. CAESAR II software makes it easy to input and display all the data needed to accurately define a piping system analysis model. It evaluates the structural responses and stresses of your piping systems to international codes and standards and enables you to access and modify, if necessary, input element by element or globally.

This intensive training course is designed to provide participants with a good working knowledge on pipe stress analysis using CAESAR II software. It covers the stress analysis; piping code history with the aspects of stress theory; the functions and usage of CAESAR-II and the mathematics behind it; the various load types and different failure criteria; the importance of pipe stress analysis; modeling issues; and the various theory of designing for expansion loads and flexibility.

At the completion of the course, participants will be able to carryout different detailed problem solving of a complex model; acquire insights on the components of buried pipe modeling; identify the elements of modes and model shapes; determine the aspects of spectral, impact and earthquake analysis, components of time history analysis, steam hammer, slug flow and relief valve firing; apply harmonic loads and harmonic analysis in piping stress; evaluate the significance of flow induced and mechanical vibrations in stress analysis; practice problem solving workshops independently; and solve a variety of stresses and equipment load problems.

Training Objectives:

By the end of the training, participants will be able to:
✓ Perform pipe stress analysis using Caesar-II software
✓ Review the roles of a stress analyst, perform stress analysis and evaluate the piping code history with the aspects of stress theory
✓ Discuss the functions and usage of CAESAR-II and the mathematics behind it and perform practical examples in line with input, analysis and redesign
✓ Enumerate the various load types and different failure criteria such as primary and fatigue failures and recognize the importance of pipe stress analysis
✓ Demonstrate modeling issues relative to bends, reducers, valves, rigid elements, control parameters, non-linearity of restraints, connecting nodes, built in databases and other modeling issues
✓ Recognize the various theory of designing for expansion loads and flexibility as well as sustained loads in relation with support configuration issues, spring hanger design, and optimization of sustained loads and perform various practical exercises
✓ Carryout different detailed problem solving of a complex model including imposed thermal displacements, verification of API 610 pump loads, local vessel flexibilities using WRC 297 and others
✓ Acquire insights on the components of buried pipe modeling, the fundamentals of dynamic analysis theory, types of loads and evaluation of system responses
✓ Identify the elements of modes and model shapes, general principles of modal analysis, load types and analysis in CAESAR-II
✓ Determine the aspects of spectral, impact and earthquake analysis, components of time history analysis, steam hammer, slug flow and relief valve firing
✓ Apply harmonic loads and harmonic analysis in piping stress and evaluate the significance of flow induced and mechanical vibrations in stress analysis
✓ Practice problem solving workshops independently and solve a variety of stresses and equipment load problems

Training Designed for:

This course is intended for those who are involved with piping in the petroleum, chemical, power, gas transmission and related industries. Further, Mechanical/Design Engineers, Piping Vessel Maintenance Engineers, Engineering Managers, Piping Designers, Plant Managers, Draftsmen, New and Experienced CAESAR-II Users can benefit from this up-to-date, information-packed short course, whether they use other pipe stress programs – or don’t use any.

Training Program:

**DAY ONE:**
- PRE-TEST
- Introduction
- Role of the Stress Analyst
- When to Perform Stress Analysis
- Piping Code History
- Stress Theory, Evaluating Stresses on Piping and Knowing which Ones Matter
- Load Types, Failure Criteria, Primary and Fatigue Failures
- Code Equations & Stress Intensification (SIFs)
- Overview of CAESAR-II Functions and How to Use the Program
- Detailed, Important Modeling Issues-Bends, Reducers, Valves, Rigid Elements, Control Parameters, Non-linearity of Restraints, Connecting Nodes, Built-in Databases and Assorted Modeling Issues
- The Mathematics Behind CAESAR-II-Stiffness Matrices and Related Issues
- Practical Examples Using CAESAR-II; Input, Analysis and Redesign

**DAY TWO:**
- Practical Examples
- Theory–Designing for Expansion Loads & Flexibility
- Practical Examples

**DAY THREE:**
- Detailed Problem Solving of a Complex Model
  - Imposed Thermal Displacements, Expansion Joint Modeling and Evaluation, Structural
Steel Modeling, Spring Hanger Design, Combining Steel with Piping, Verification of API 610 Pump Loads, Local Vessel Flexibilities Using WRC 297, Including Vessel Modeling, Evaluation of Local Vessel Stresses According to WRC 107

❖ Problem Solving Workshop-Detailed Example where Each Student Works Independently and Applying What is Learned to Solve a Variety of Stresses and Equipment Load Problems
❖ Buried Pipe Modelling

DAY FOUR:
❖ Dynamic Analysis Theory, Types of Loads and Evaluation of System Responses
❖ Modes and Mode Shapes
❖ Modal Analysis
❖ Spectral Analysis, Impact and Earthquake Analysis
❖ Time History Analysis
❖ Flow Induced Loads and Harmonic Analysis
❖ Mechanical Vibration
❖ Simulator (Hands-on Practical Sessions)
  • Practical sessions will be organized during the course for participants to practice the theory learnt. Participants will be provided with an opportunity to carryout various exercises using the state-of-the-art “CAESAR II Software”

DAY FIVE:
❖ Impact Load Types and Analysis
❖ Steam Hammer, Slug Flow, Relief Valve Firing
❖ Example Problems
  • Mechanical Induced Vibration Problems and Solutions, Flow Induced Vibration Problem Solution, Time History Analysis and Evaluation of Impact Load (Steam Hammer) with Dynamic Restraint (Snubber), Spectral Analysis of Impact Load (Relief Valve Firing), Earthquake Analysis
❖ Course Conclusion
❖ POST-TEST and EVALUATION

Training Requirement:

“Hands-on practical sessions, equipment and software will be applied during the course if required and as per the client’s request.”

Practical sessions will be organized during the course for participants to practice the theory learnt. Participants will be provided with an opportunity to carryout various exercises using the state-of-the-art “CAESAR II Software.”

Please note that the above topics can be amended as per client’s learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.
Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

As per the course location - This rate includes participant’s manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:
07:45 - 08:00 Morning Coffee / Tea
08:00 - 10:00 First Session
10:00 - 10:20 Recess (Coffee/Tea/Snacks)
10:20 - 12:20 Second Session
12:20 - 13:30 Recess (Prayer Break & Lunch)
13:30 - 15:00 Last Session

For training registrations or in-house enquiries, please contact:
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Training & Career Development Department