NA Regional Summit 2008 NAFEMS

2020 Vision of Engineering Analysis and Simulation

October 29 - 31, 2008 | Hampton, Virginia

Training the Next Generation of Simulation Engineers: NAFEMS Initiative in Skills Management

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NAFEMS

Themes of NAFEMS

- Three primary themes
  - Software (80's to 90's)
  - Processes (90's to 00's)
  - People (00's to…)

- Associated activities (through committees of expert volunteers):
  - Benchmark problems
  - Publications
  - Seminars / conferences / training courses

Skills Management Initiative: Background

- Use of simulation growing
- Lack of suitably qualified and experienced engineers to perform the simulation
- Companies turning to alternative manpower resources
- How to manage the skill set of in-house and external simulation engineers?

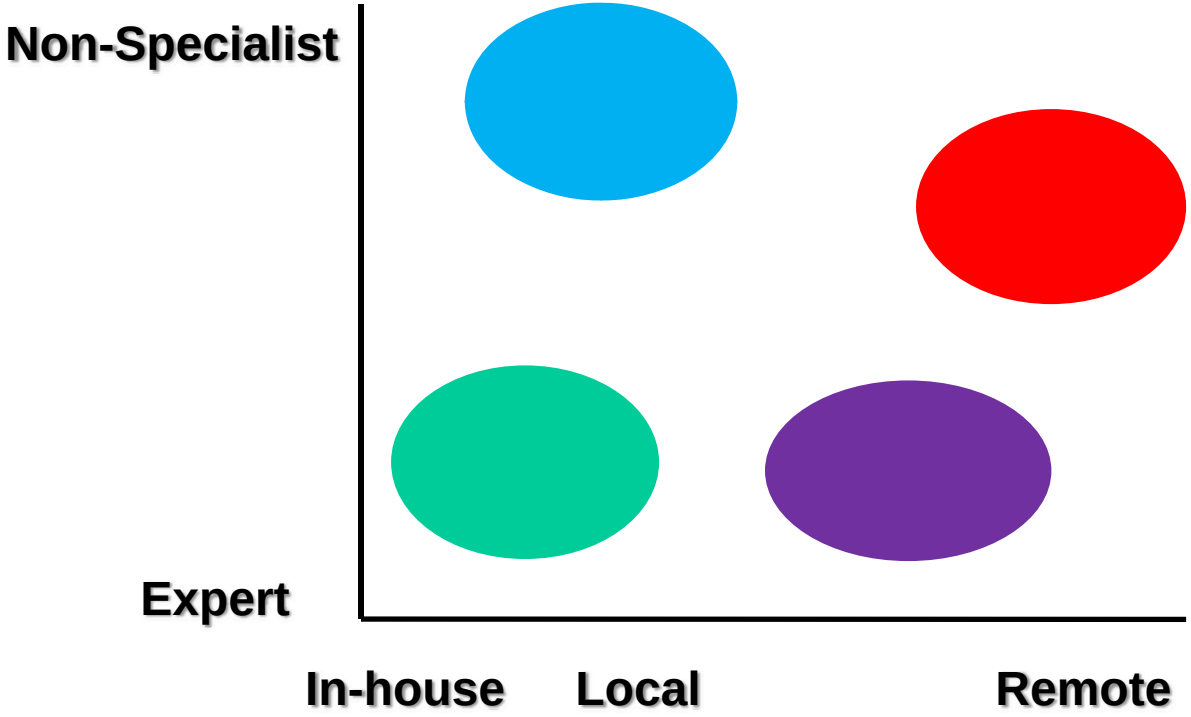
Skills Management Initiative: First Steps

- Consult with industry, academia and software vendors
  - Meeting with vendors at last NAFEMS World Congress
  - Meeting with industry in London: April 2008
  - Meeting in Paris: September 2008
  - Meeting in Berlin: October 2008
  - Meeting in USA: October 2008
- Looking to establish the needs

Who does Engineering Simulation and Where do They do it?

- In-House
  - Expert
  - Non-Specialist
- Contractor
  - Known “Local”
  - Unknown “Remote”

Who does Engineering Simulation and Where do They do it?



What are the Essential Skills for Engineering Simulation?

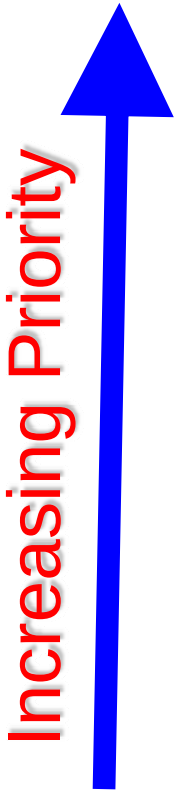
- Technology
- Tools
- Process

A Framework for Establishing Competency.

What Could NAFEMS Do?

- Define a Modular Set of Learning Outcomes
- Provide Training Material for each Module
- Deliver the Training for each Module
- Examine/Certify Learners
- Accredit Training Providers

Findings From Industry Consultation



Should NAFEMS develop & publish a modular set of learning outcomes?

Should NAFEMS develop training material for these modules?

Should NAFEMS provide information about third party courses which do deliver the learning outcomes?

Should NAFEMS accredit training providers?

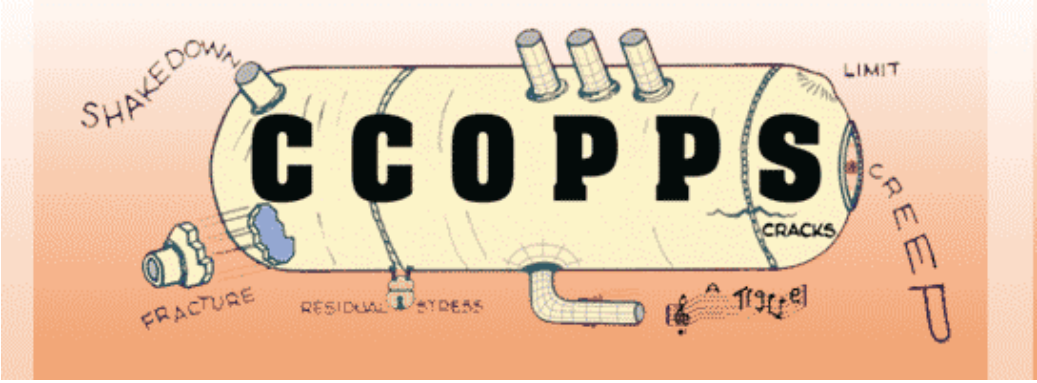
Should NAFEMS examine and provide certificates for the learners?

Should NAFEMS provide training courses for these modules?

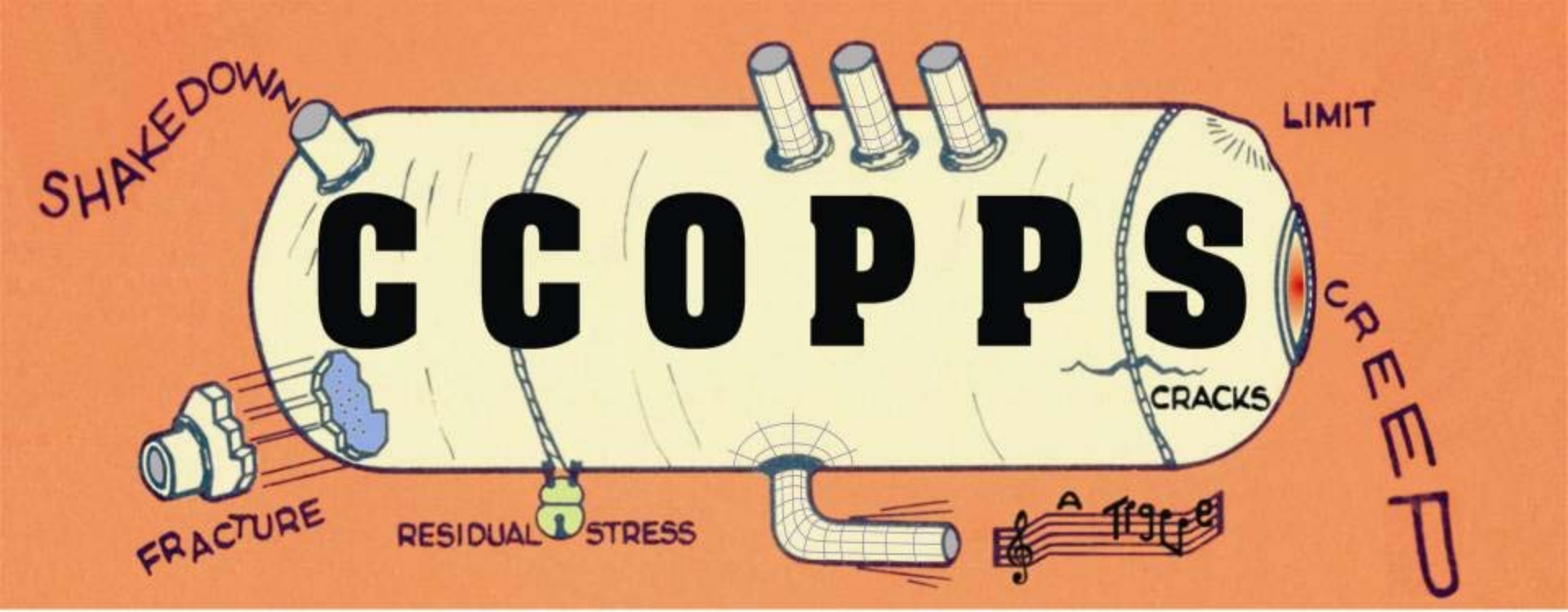
How can this be Implemented?

- NAFEMS Task Force
  - Led by NAFEMS
    - Management and Administration
  - Management Board
    - Industrial Users
      - Define Goals and Approve Outcomes
  - Project Board
    - Industrial Users, Software Vendors, Academics
      - Refine Goals and Commission Outcomes
- Build on Outcomes from CCOPPS Project

CCOPPS Project



- Certification of Competencies in the Power & Pressure Systems Industry
- 2 year Leonardo da Vinci Project
- Led By University of Strathclyde
- NAFEMS is part of project consortium



INDUSTRY NEEDS SURVEY

Further analysis

DOMAIN EXPERTS

Finished

http://www.ccopps.eu/

EDUCATIONAL BASE

90% complete
CPD Modules launched 2009

WORK-BASED LEARNING MODULES

INDUSTRY FEEDBACK

Currently underway

Beams Membranes Plates and Shells

FEA of Pressure Systems and Components

$$[M][u'']+[C][u']+[K][u]=[F]$$

Buckling and Instability

Flaw Assessment in Pressure Components

Code of Practice Philosophy and Application

Mechanics, Elasticity and Strength of Materials

Composites

Nonlinear Geometric Effects and Contact

Creep and Time-Dependency

Plasticity and Shakedown

Design by Analysis

Pressure System Components and Fabrication

Dynamics and Vibration

Pressure Vessel Materials

Fatique

Thermo-Mechanical Behaviour

FEAap12	Employ a range of post-solution checks to determine the integrity of FEA results.	S, 6	FEAref68
FEAap13	Use through-thickness stress linearization facilities where appropriate.	S, 7	FEAre
FEAap14	Carry out sensitivity studies.	S, 7	FEAre
FEAap15	Model pipework bends, weldments and systems effectively.	A, 7	FEAre
FEAap16			
FEAap17			
Analysis			
FEAan1	Analyse the results from small displacement, linear static analyses and determine whether they satisfy inherent assumptions.	S, 6	FEAref72
FEAan2	Compare the results from small displacement, linear elastic analyses with allowable values and comment on findings.	S, 6	FEAref73
FEAan3	Analyse the results from sensitivity studies and draw conclusions from trends.	A, 7	FEAref74
FEAan4	Develop an analysis strategy that enables the relative significance of individual model parameters and their interactions to be evaluated	A, 7	FEAref75
Synthesis			
FEAsy1	Prepare an analysis specification, including modelling strategy, highlighting any assumptions relating to geometry, loads, boundary conditions and material properties.	A, 7	FEAref76
FEAsy2	Plan an analysis, specifying necessary resources and timescale.	A, 7	FEAref77
FEAsy3	Prepare quality assurance procedures for finite element analysis activities within an organisation.	A, 7	FEAref78
FEAsy4	Contribute to planning related to the effective development of analysis facilities.	A, 7	FEAref79
FEAsy5	Contribute to the development of a competency process that supports staff technical development.	A, 7	FEAref80
Evaluation			
FEAev1	Select appropriate idealisation(s) for components / structures, which are consistent with the objectives of the analyses.	A, 7	FEAref81
FEAev2	Assess the significance of neglecting any feature or detail in any idealisation.	A, 7	FEAref82
FEAev3	Assess the significance of simplifying geometry, material models, loads or boundary conditions.	A, 7	FEAref83
FEAev4	Manage physical and human resources within an organisation; in an effective manner.	A, 7	FEAref84

How to Interpret Finite Element Results, Baguley D and Hose D R, Chapter 4 pp 29-34, NAFEMS, 1997

Guide for Verification and Validation in Computational Solid Mechanics, ASME V&V 10-2006

NAFEMS QSS 001:2007, Engineering Simulation, Quality Management Systems, Requirements

Print

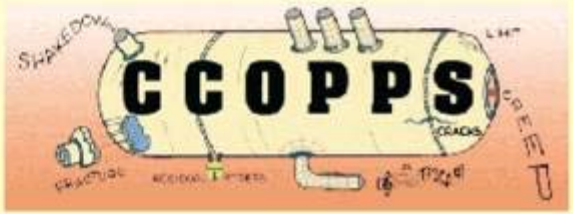
Print All

COMPETENCE CODE	RESOURCE REFERENCE	STANDARD LEVEL	ADVANCED LEVEL	EQF LEVEL
FEAap10	*FEAref66*	X		7

1. COMPETENCE STATEMENT (Complete achievement record for 1,2 or 3)	ACHIEVED	
Illustrate various physical situations which will result in a Stress Singularity and explain why it is not appropriate to use finite element results at such locations directly.	Formally ○	Informally ○
	ATTESTING SIGNATURE	

2. MINIMUM THRESHOLD INTERPRETATION	ACHIEVED	
Recognises that stress singularities can occur at locations such as corners, material interfaces, crack tips, structural interfaces.	Formally ○	Informally ○
	ATTESTING SIGNATURE	

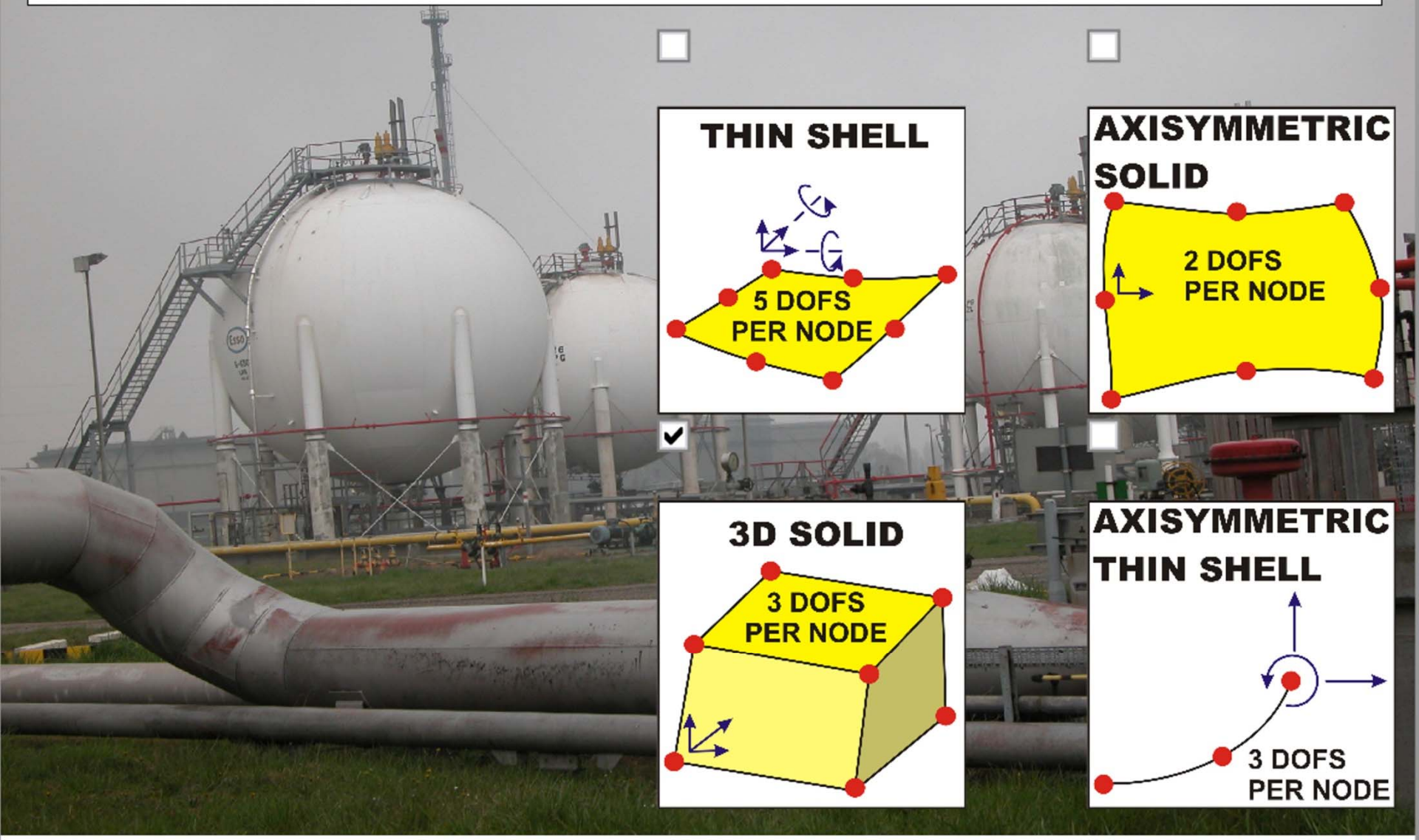
3. COMPREHENSIVE THRESHOLD INTERPRETATION	ACHIEVED	
Is able to describe why stresses at these locations are unrealistic and can't be used. Recognises that there may be other parameters that can be evaluated from the analysis other than direct body stresses. Aware of techniques that are available to model regions with known stress singularities such as the extraction of Stress Intensity factors from special purpose meshes at crack tips.	Formally ○	Informally ○
	ATTESTING SIGNATURE	



NAME	DATE
	28 Sep 2008

http://www.ccopps.eu/

Which is the best element to determine the hot-spot stresses at the intersections of the multi-mitred pipe bend?



Check Answer | Explanation | Yes that is correct. | 5 / 26

Which is the best element to determine the hot-spot stresses at the intersections of the multi-mitred pipe bend?

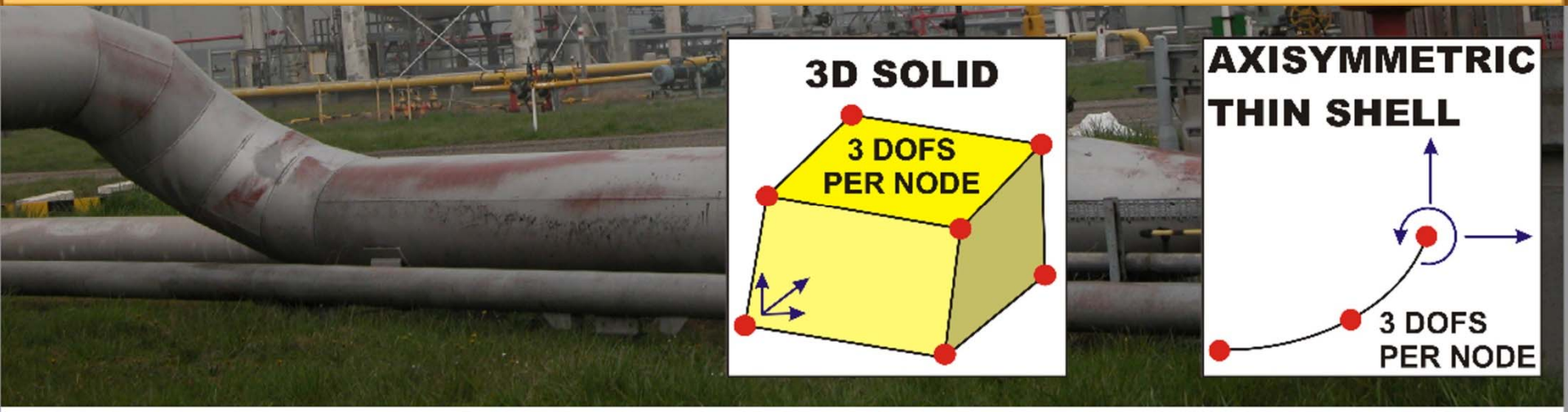
☐ ☐

Answer:

3D Solid

Explanation:

The multi-mitre geometry is clearly not axisymmetric. While hot-spot stresses can be obtained from thin-shell elements, a 3D solid representation would allow both surface extrapolation and through-thickness linearization techniques to be used. This type of idealization would avoid the inherent approximations of thin shell theory and would also allow the actual weld-profile and any toe grinding to be modeled as well if necessary. Given today's typical computing resources, such a level of idealizations is perfectly feasible.



Check Answer | Explanation | Yes that is correct. | 5 / 26 | ▶

Check Answer | Reset | Explanation | Click the Check Answer

Summary

- Use of Simulation Changing
  - Experts
  - Designers
  - Offshoring
- Industry wants better management of simulation skills
- Role for NAFEMS in Pooling Knowledge & Resources
- Future initiative for NAFEMS
- Will Build on Foundations Laid by CCOPPS Project

Get Involved!