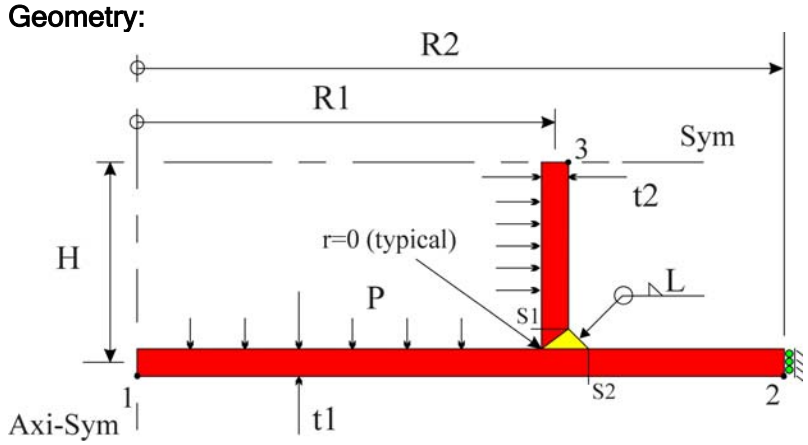
Number:	Title:	Date:
FENET_E&D1	Shell Intersection.	14th December 2003

Statement of Purpose:

The main purpose of this procedural benchmark is to identify the limitations of modelling practices currently in use, using plate/shell elements, for adequate representation of the stiffness and stresses in large fabrications containing intersections that exhibit a slope discontinuity in shell/plate midsurfaces.

The stresses and deflections in the fabricated detail shown are to be determined using common industrial modelling practices. Target solution quantities required for deflection and stresses have been specified. However, you should feel free to determine and use any additional result quantity at any location in the model, which would enable determination of the margins against static failure and fatigue. Please use any elastic failure criteria appropriate to your industry sector, to establish such margins.

Geometry:



R1 = 650 mm; R2 = 1000 mm
H = 300 mm; t1 = 20mm
t2 = 15 mm; L = 15mm (leg length)
Neglect self-weight; 45 degree full penetration fillet

Analysis Type(s):

Linear material, static, small displacement.

Material:

EN10025 S355 JR steel (old BS 4360 Grade 50B) in the as-rolled, as-welded condition.
Young's Modulus = 200000 N/mm^2; Poisson's Ratio = 0.3; Minimum Yield Strength = 235 N/mm^2 for t<16mm (225 for 16<t<40); Fatigue strength (stress range) for plain plate = 280 N/mm^2 with a 2.3% (2SD) probability of failure.

Loading:

Internal pressure P = 0.2 N/mm^2 @ 2x10e6 cycles (0 … P … 0).

Boundary Conditions:

See figure above.

Target Solution Quantities Required for Comparison:

Deflections at points 1, 2 and 3; Principal stresses at point 1; Principal stress distributions through the thickness at sections s1 and s2.

Indicate also: Elastic stress(es) to be used for assessment of static failure margin(s) and “Hot-spot” stress(es) for fatigue assessment.

(For final comparative purposes, please provide deflections in “mm” and stresses in “N/mm^2” to 1 decimal place).

Idealisations:

Although the structure is 2D, the intention is that it should be representative of large general plate/shell fabrications. With this in mind, idealisations using general 3D plate/shell elements are required. 3D solids (if commonly used in say a “nested” modelling strategy for large structures) would also be welcome for comparative purposes.

Results for axisymmetric shell models and 2D solid of revolution models will also be useful for comparative purposes.

Further Considerations:

Useful references:

1. SJ Maddox. Fatigue Strength of Welded Structures, Woodhead Publishing, Second Edition, ISBN 1 85573 013 8, 1991.

PROCEDURAL BENCHMARK
RESULTS

Number:	Title:
FENET_E&D1	Shell Intersection.

e-mail Address of Person Submitting: *(Note … identities of people and organisations will not be disclosed. This information is required in case communication is necessary)*

Date:

Idealisation: (Use multiple results sheets for each idealisation if required)

Mesh Used:

System and Element(s) Used:

Assumptions and Approximations (including statement of significance):

PROCEDURAL BENCHMARK
RESULTS

Results for Comparative Target Solution Quantities:

Additional FE Results used for Engineering Assessment:

Relevant Codes of Practice, Industry Standard and/or Statement of Assessment Criteria:

Description of Results Post-processing (where relevant):

Engineering Conclusion(s):

1. Is the detail fit for purpose for static strength (Y/N) and fatigue (Y/N)?
2. Would this detail be allowed under any Codes of Practice prevalent in your industry sector (state which sector and Code)?
   Y/N
   Sector:
   Code of Practice: