

Pressure Vessel - Verification and Validation

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Verification and Validation

"Verification and validation" can be thought of as a formal process for checking results. We previously performed some sanity checks on the deformed shape. A further basic check is how the results change on refining the mesh. The following video shows how to recalculate the results on a refined mesh. Note that it comes from a different project, but the procedure is the same.

Mesh refinement results:

		FEA (Element size: 0.1in)	FEA (Element size: 0.05in)	FEA (Element size: 0.01in)
HOOP STRESS (psi)	Inner Surface	3566.9	3570	3570
	Outer Surface	2569.7	2570.9	2570.9
AXIAL STRESS (psi)	(Constant for both theories)	1285.8	1285.8	1285.8
RADIAL STRESS (psi)	Inner Surface	-995.4	-998.5	-998.5
	Outer Surface	1.7	0.5	0.5

Our results don't change significantly on refining the mesh. The medium and finest meshes yield virtually identical results. So we'll use the results from the medium mesh (element size of 0.05 in) to compare with the thin-walled and thick-walled hand calculations.

Comparison with thin and thick-walled theory from the pre-analysis:

		FEA Axisymmetric	Thin-Wall Equation	Thick-Wall Equation
HOOP STRESS (psi)	Inner Surface	3570	3000	3571.4
	Outer Surface	2570.9	3000	2571.4
AXIAL STRESS (psi)	(Constant for both theories)	1285.8	1500	1285.7

		FEA Axisymmetric	Boundary Conditions
RADIAL STRESS (psi)	Inner Surface	-998.5	-1000
	Outer Surface	0.5	0

Our FEA results compare very well with thick-walled theory where agreement is within 0.01-0.03% with theory. The thin-walled theory is beginning to lose validity. For this geometry, the FEA predictions differ from thin-walled theory by as much as 20%.

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