Comparative Analysis of Cotter Joint Using Ansys and Simsolid

Deepanker Shukla

ORCID 0000-0002-3870-0761

Abstract

This paper documents comparision between traditional FEA and Simsolid assembly analysis.

Keywords

Catia, Ansys, Simsolid, Cotter.

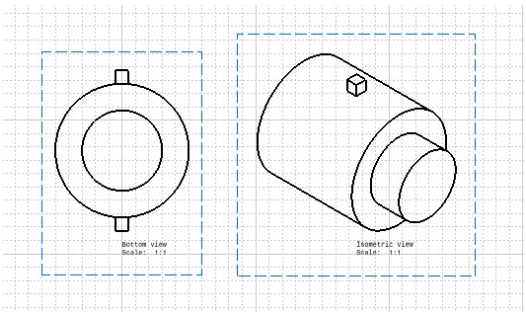
Introduction

A cotter joint, also known as a socket and spigot joint, is a method of temporarily joining two coaxial rods.

Simsolid eliminates geometry preparation and meshing: the two most time-consuming, expertise-extensive, and error-prone tasks performed in a conventional structural simulation.

Ansys Mechanical is a best-in-class finite element solver with structural, thermal, acoustics, transient and nonlinear capabilities to improve your modeling.

Design and Analysis



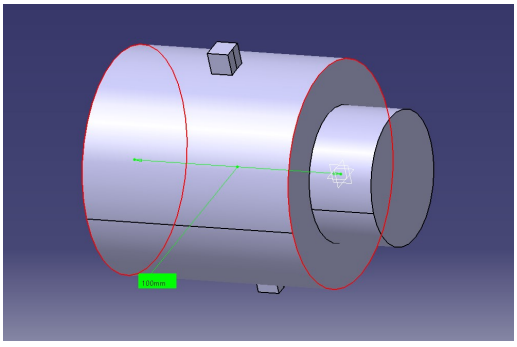


Figure 1 and 2

The design has been done in Catia V5 using part and assembly design. (shown in fig. 1 & 2) Socket has outer radius of 50 mm and inner radius of 30 mm, length being 100 mm and the pocket has been done 40 mm from spigot insertion side. Spigot is a solid cylinder having radius of 30 mm and height of 100 mm of which 30 mm is outside socket. The pocket has been done while keeping

alignment in mind. The cotter has dimensions of 10x10x120 and fits so that assembly has horizontal symmmetry.

Note: The geometry has been exported to/imported in Ansys as well as Simsolid in stp file format.

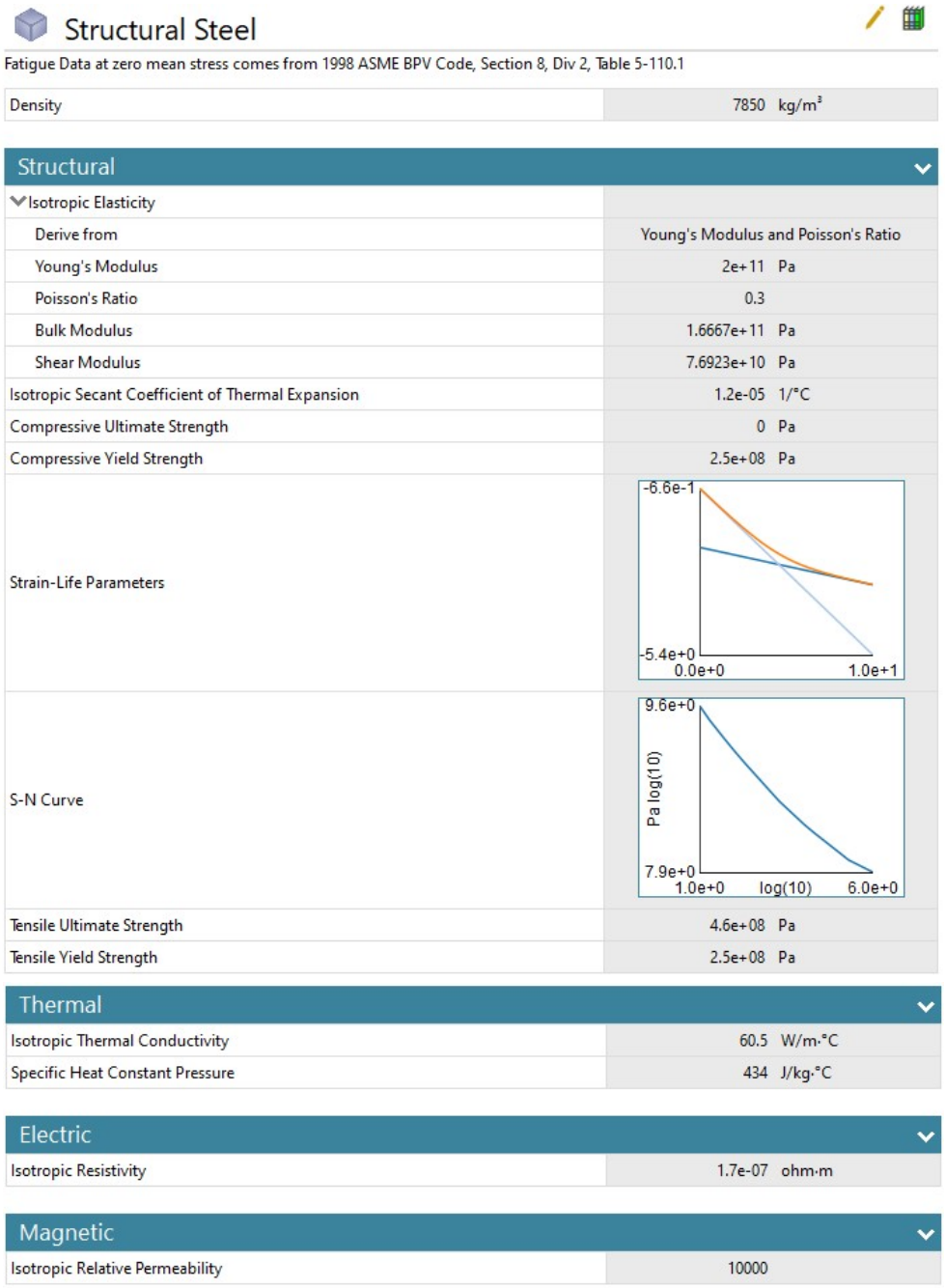


Figure 3

In Ansys Workbech, Structural steel has been selected as default material as shown in figue 3 above.

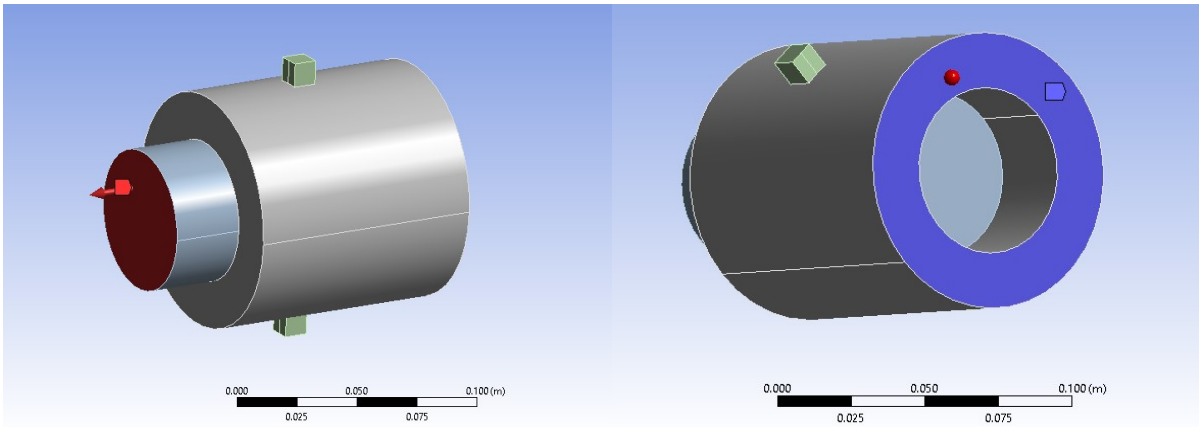


Figure 4 & 5

The force of 1000N has been defined on spigot (fig. 4) and a fixed connection has been applied on socket (fig.5).

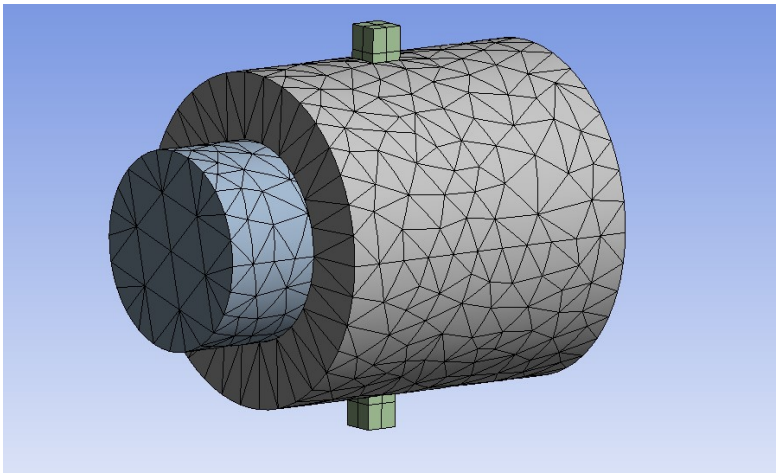


FIgure 6 (default mesh)

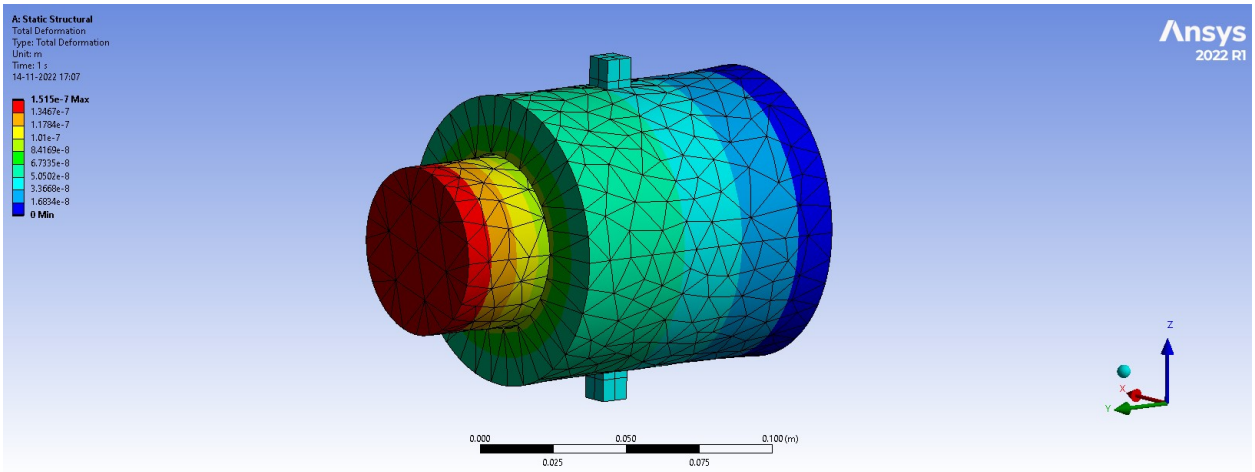
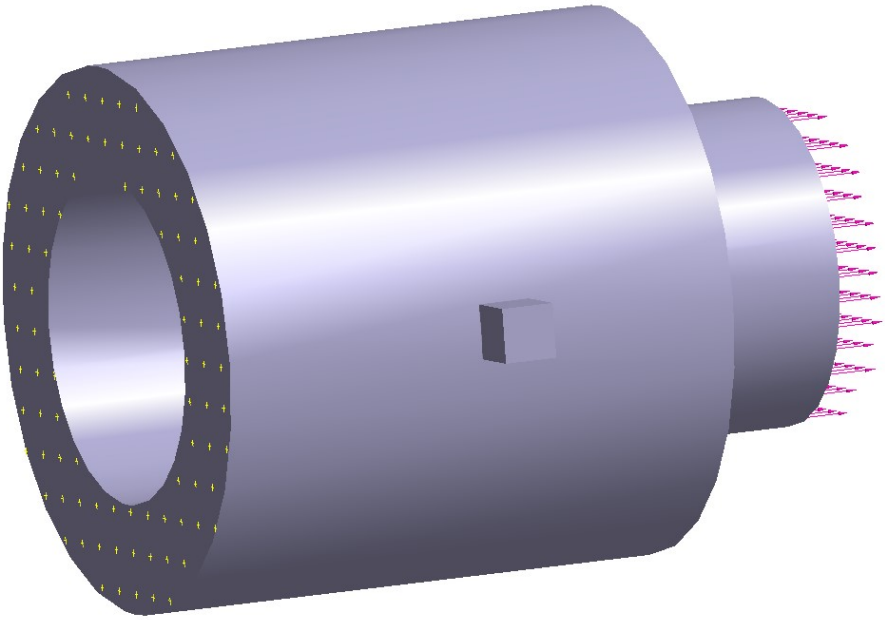


Figure 7

In figure 7, the maximum deformation predicted by Ansys is 1.515e-7 in metres.



Design study 1 | Structural 1

Property	Value	Units
Mechanical properties		
Elasticity modulus	2.0000000000e+11	[pa]
Poisson's ratio	2.9000000000e-01	[dimensionless]
Density	7.8200000000e+03	[kg/m^3]
Ultimate tensile stress	3.8000000000e+08	[pa]
Tensile yield stress	2.0500000000e+08	[pa]
Compressive yield stress	2.0500000000e+08	[pa]
Default failure criterion	Von Mises Stress	
Thermal expansion coefficient	1.1500000000e-05	[1/(degree C)]
Thermal properties		
Thermal conductivity	5.0000000000e+01	[W/(m*K)]

Figure 8

Same geometry has been imported in Altair Simsolid and forces/constraints have been applied appropriately with same material (steel) as illustrated in figure 8.

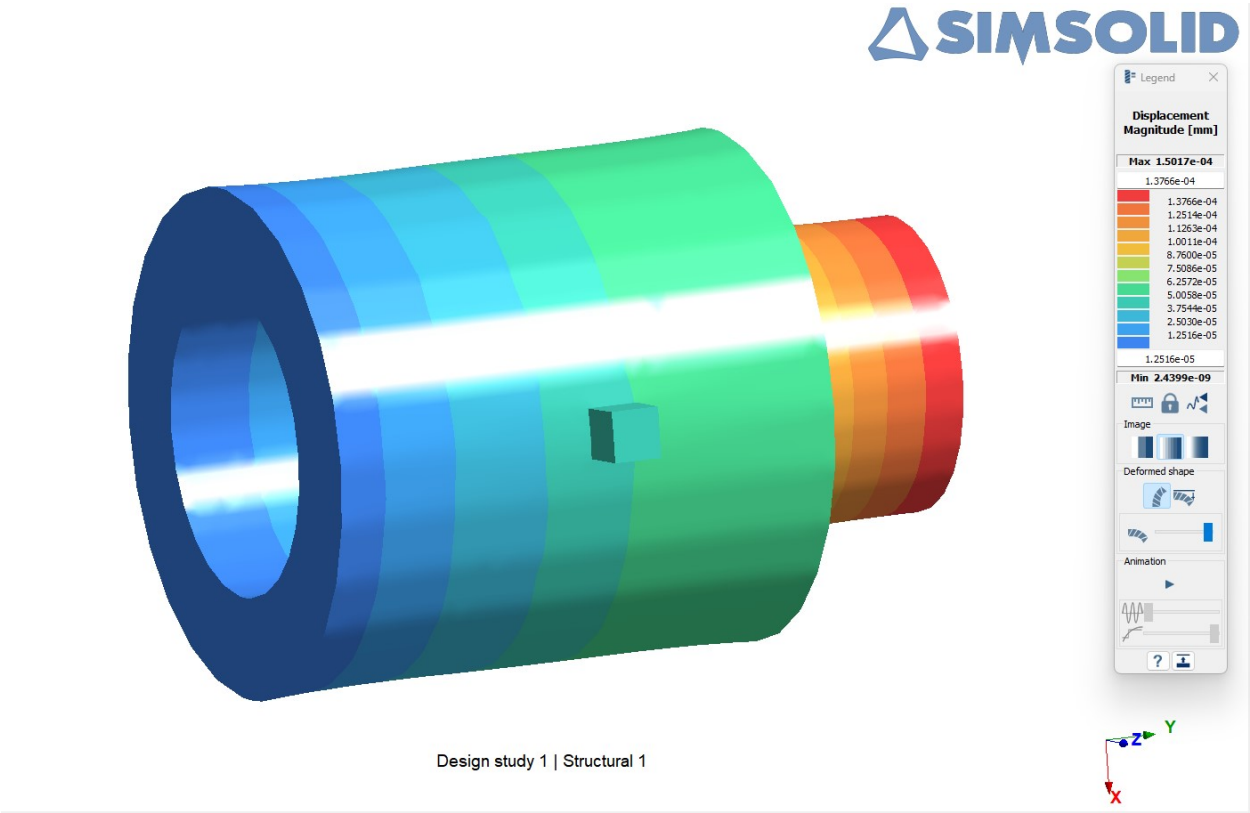


Figure 9

In figure 9, the result for maximum deformation given by Simsolid's analysis is 1.5017e-04 in mm which when converted into metres will be the same order of magnitude of the max. def. given by Ansys Mechanical in figure 7.

The Similarity therefore is:

(1.5017/1.515) x 100 % = 99.12%

Conclusion

Simsolid's new method is reliable and fast when compared to Ansys Mechanical's FEA.

References (Software Used)

[1] Catia P3 V5 6R2021

[2] Ansys 2022 R1

[3] Simsolid 2022.0.1