Mechanics of Materials

Project 2 - 3

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I. Bending

Components	Applied Forces	Reactions	Residual	Relative Magnitude Error
Fx (N)	3.5344e-014	-2.0300e-009	-2.0300e-009	1.1787e-013
Fy (N)	-2.0000e+003	2.0000e+003	-7.9427e-008	4.6119e-012
Fz (N)	2.1990e-014	-4.3156e-010	-4.3153e-010	2.5057e-014
Mx (Nxm)	6.0000e+001	-6.0000e+001	4.2880e-009	6.2245e-013
My (Nxm)	1.0441e-014	2.4113e-010	2.4114e-010	3.5004e-014
Mz (Nxm)	8.0000e+002	-8.0000e+002	5.2298e-009	7.5916e-013

Table 1 Analysis of Forces for Bending

Criterion	Good	Poor	Bad	Worst	Average
Stretch	455 (11.70%)	3433 (88.30%)	0 (0.00%)	0.107	0.245
Aspect Ratio	199 (5.12%)	966 (24.85%)	2723 (70.04%)	10.205	5.979

Table 2 Element Quality for Bending

Material	Steel
Young's modulus	2e+011N_m2
Poisson's ratio	0.266
Density	7860kg_m3
Coefficient of thermal expansion	1.17e-005_Kdeg
Yield strength	2.5e+008N_m2

Table 3 Analysis of Material for Bending

Strain Energy :
7.442e-001 J

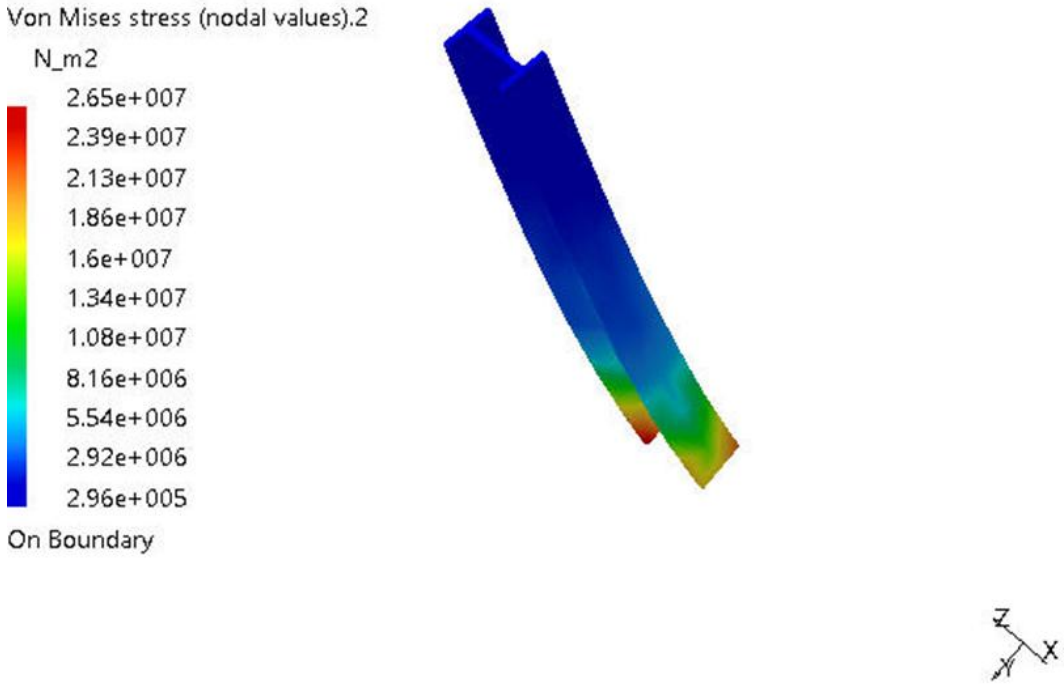

Figure 11 Stress Distribution for Bending

II. Torsion

Components	Applied Forces	Reactions	Residual	Relative Magnitude Error
Fx (N)	-3.3181e-012	4.9624e-011	4.6306e-011	2.9749e-015
Fy (N)	1.3733e-004	-1.3733e-004	3.9672e-009	2.5487e-013
Fz (N)	1.1601e-011	5.9981e-010	6.1141e-010	3.9280e-014
Mx (Nxm)	-1.5000e+003	1.5000e+003	-3.7971e-010	6.0986e-014
My (Nxm)	4.6187e-012	2.2214e-010	2.2676e-010	3.6420e-014
Mz (Nxm)	-5.4932e-005	5.4931e-005	-7.3476e-010	1.1801e-013

Table 4 Analysis of Forces for Torsion

II. Torsion

Criterion	Good	Poor	Bad	Worst	Average
Stretch	1 (0.08%)	1273 (99.92%)	0 (0.00%)	0.057	0.140
Aspect Ratio	46 (3.61%)	255 (20.02%)	973 (76.37%)	18.125	9.773

Table 5 Element Quality for Torsion

II. Torsion

Material	Steel
Young's modulus	2e+011N_m2
Poisson's ratio	0.266
Density	7860kg_m3
Coefficient of thermal expansion	1.17e-005_Kdeg
Yield strength	2.5e+008N_m2

Table 6 Analysis of Material for Torsion

Strain Energy :
8.961e-001 J

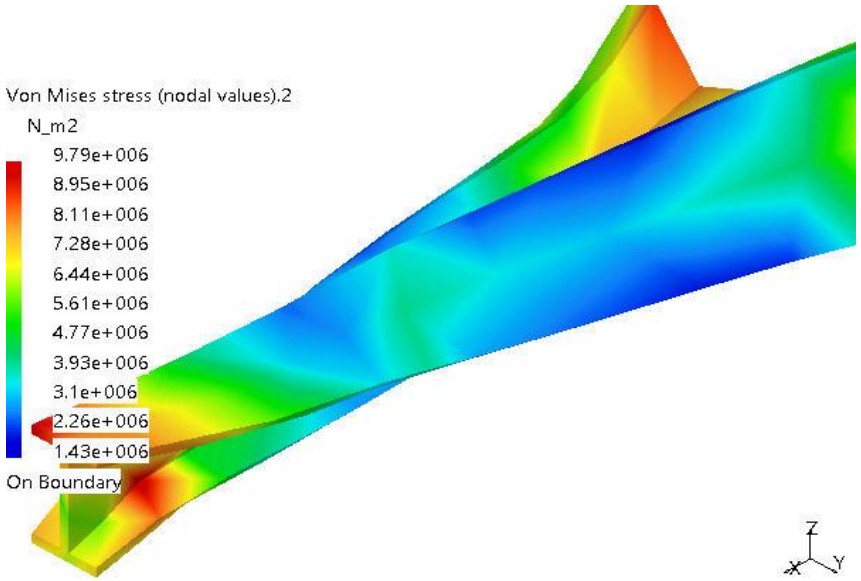

Figure 12 Stress Distribution for Torsion

III.Tension (Axial)

Components	Applied Forces	Reactions	Residual	Relative Magnitude Error
Fx (N)	0.0000e+000	-1.0791e-007	-1.0791e-007	2.1336e-012
Fy (N)	0.0000e+000	1.9884e-008	1.9884e-008	3.9314e-013
Fz (N)	0.0000e+000	-8.1084e-008	-8.1084e-008	1.6032e-012
Mx (Nxm)	0.0000e+000	-3.9302e-010	-3.9302e-010	1.7268e-014
My (Nxm)	0.0000e+000	-1.6058e-008	-1.6058e-008	7.0554e-013
Mz (Nxm)	0.0000e+000	-1.7352e-009	-1.7352e-009	7.6242e-014

Table 8 Analysis of Forces for Tension

III. Tension (Axial)

Criterion	Good	Poor	Bad	Worst	Average
Stretch	116790 (100.00%)	0 (0.00%)	0 (0.00%)	0.371	0.658
Aspect Ratio	114183 (97.77%)	2607 (2.23%)	0 (0.00%)	4.059	1.745

Table 9 Element Quality for Tension

III.Tension (Axial)

Material	Steel
Young's modulus	2e+011N_m2
Poisson's ratio	0.266
Density	7860kg_m3
Coefficient of thermal expansion	1.17e-005_Kdeg
Yield strength	2.5e+008N_m2

Table 10 Analysis of Material for Tension

Strain Energy :
7.663e+003 J

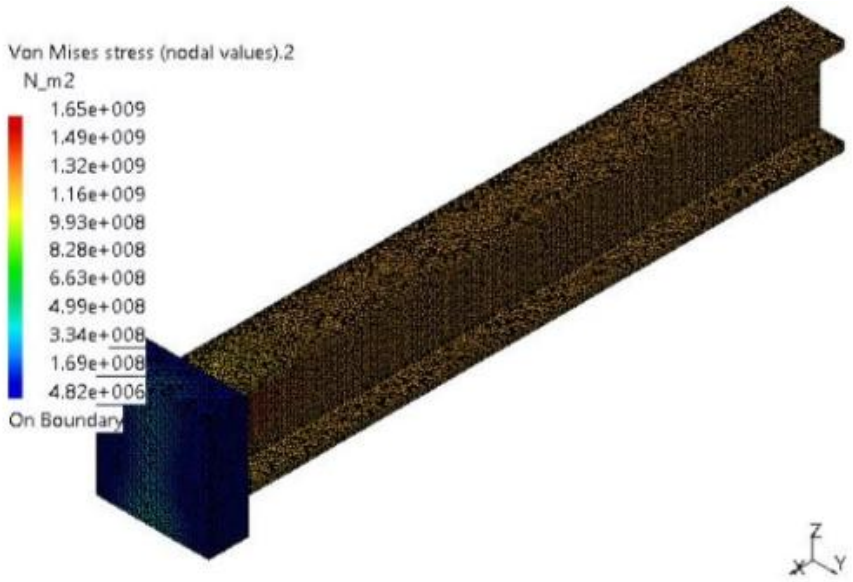

Figure 13 Stress Distribution for Tension