Analysis of a Brake System

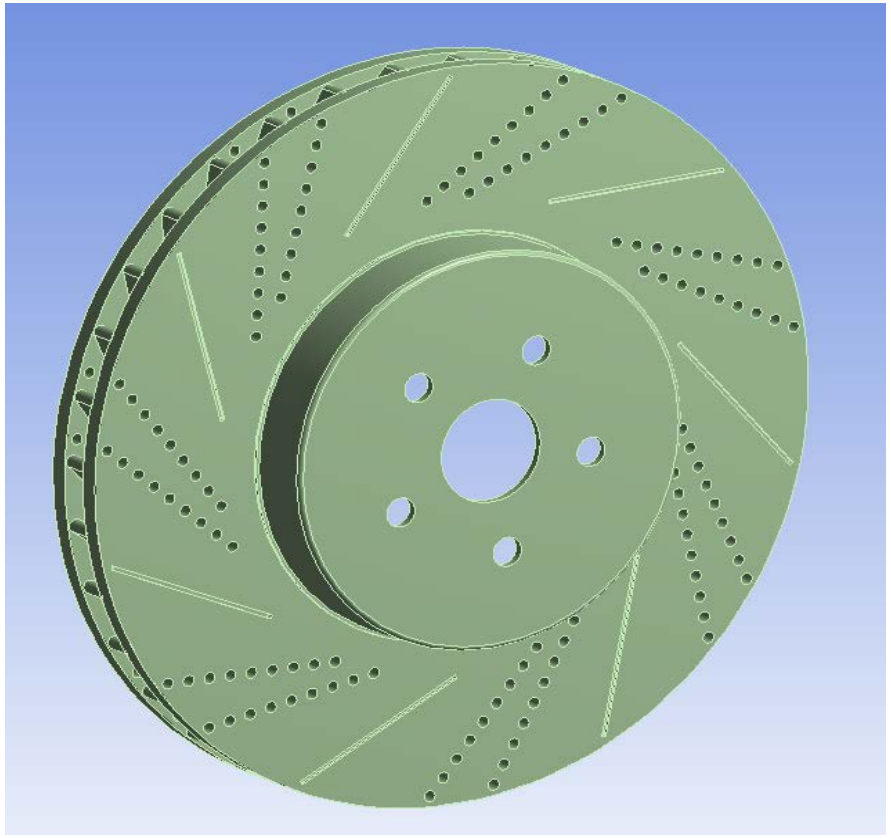
Mike Emerson | FEM Final Project

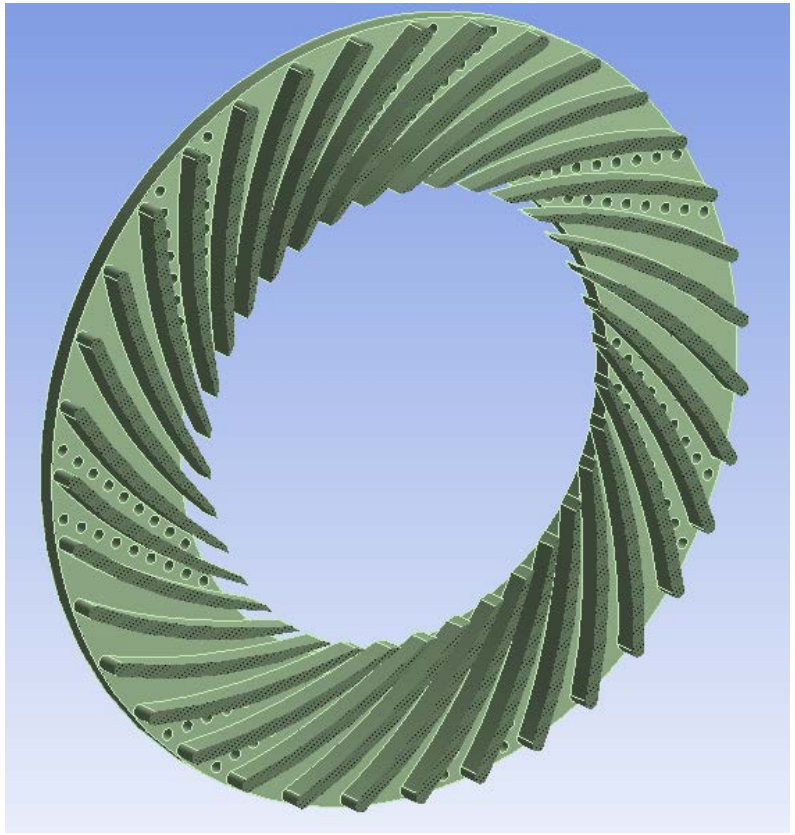
Overview

- Geometry and Material
- Static Analysis
- Steady State Thermal Analysis
- Modal Analysis
- Conclusions

Geometry and Material

- Geometry is a simplified Brembo automotive brake system





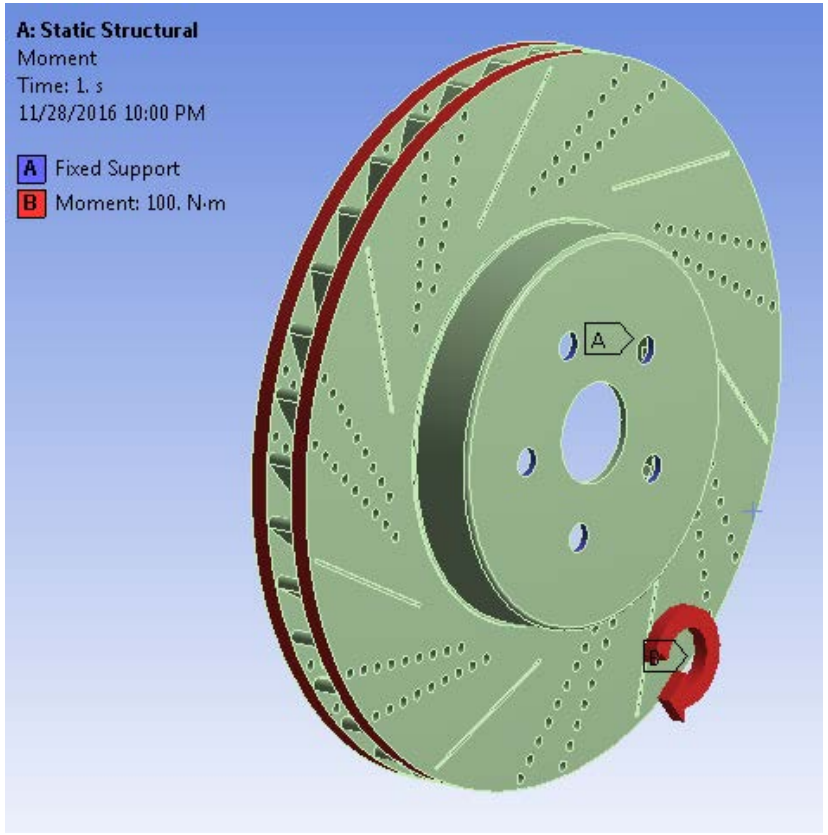
Geometry and Material

- Material is Structural Steel with the following properties:

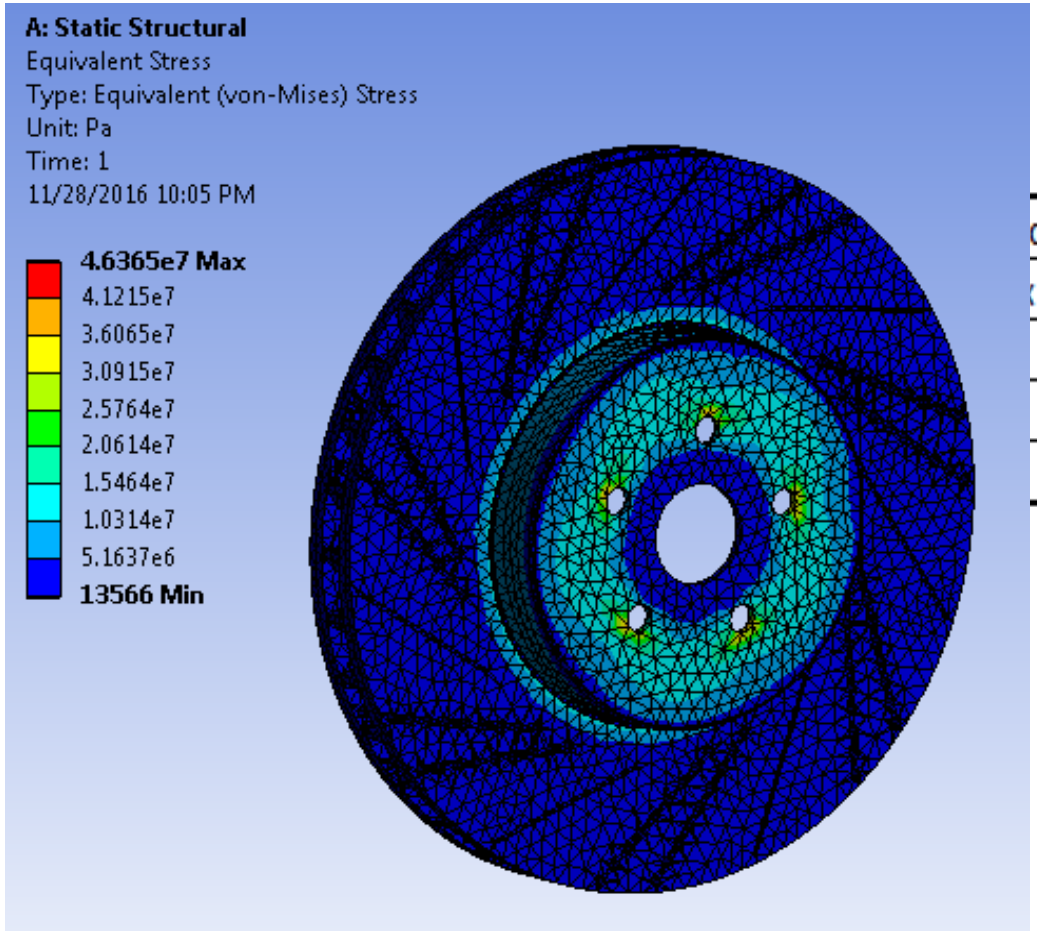
Material Properties - Structural Steel		
Density	7850	kg m^-3
Young's Modulus	2.0 E+11	Pa
Poisson's Ratio	0.3	
Thermal Expansion Coefficient	1.20E-05	C^-1
Zero-Thermal-Strain Reference Temperature	22	C

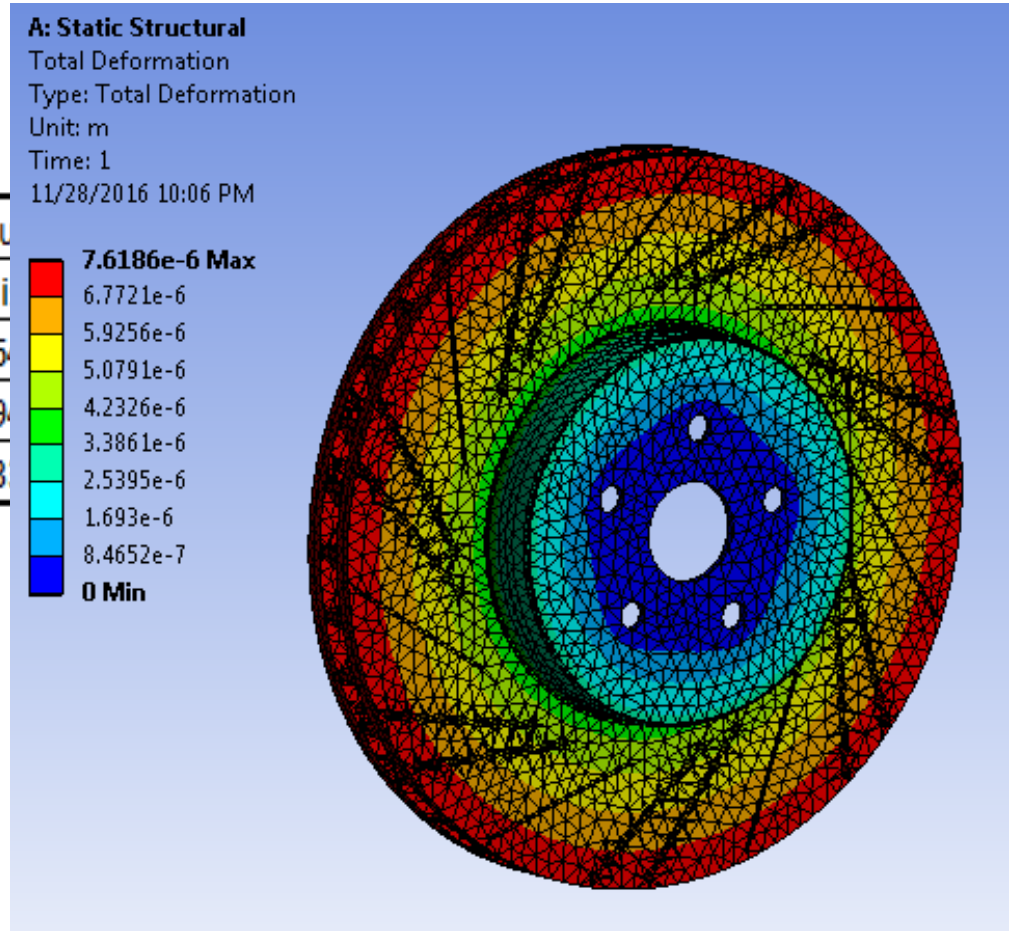
Static Analysis – Boundary Conditions

- 100 Nm moment applied as well as fixed supports at bolt holes



Static Analysis – Results

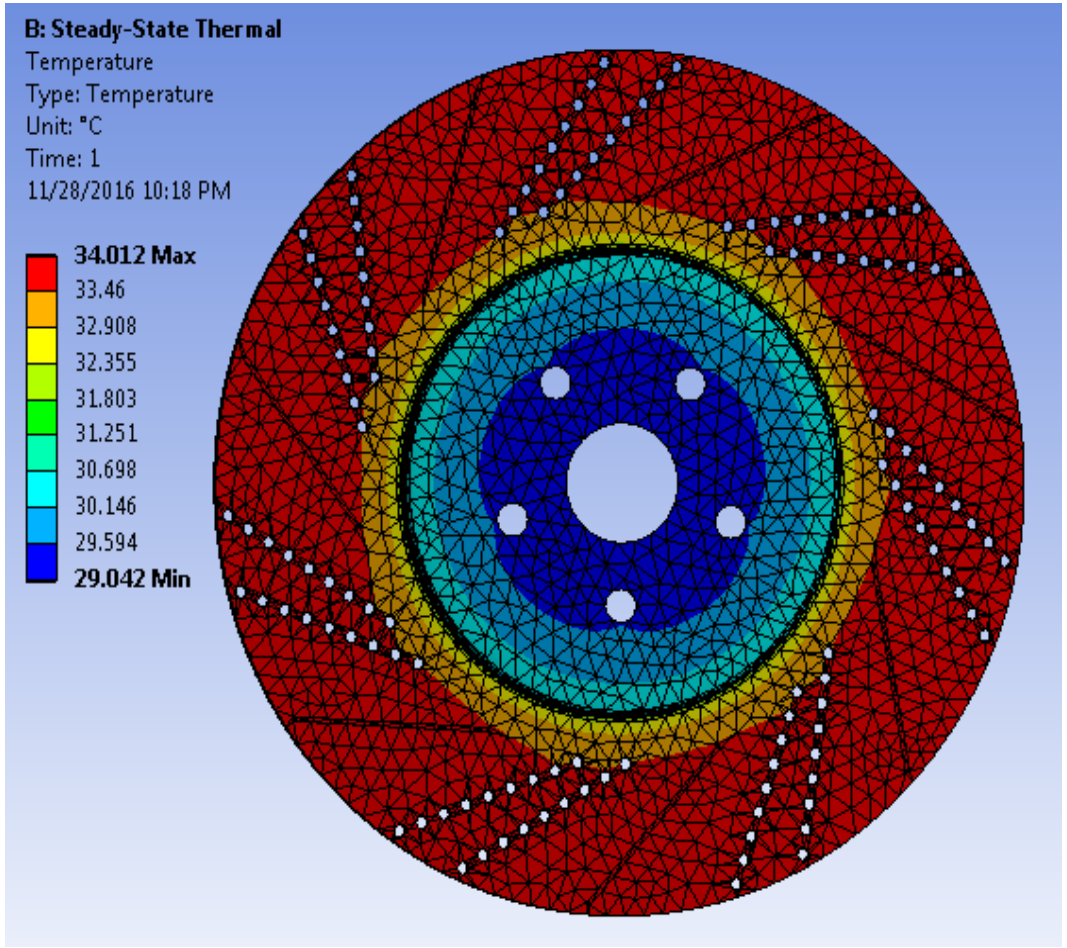


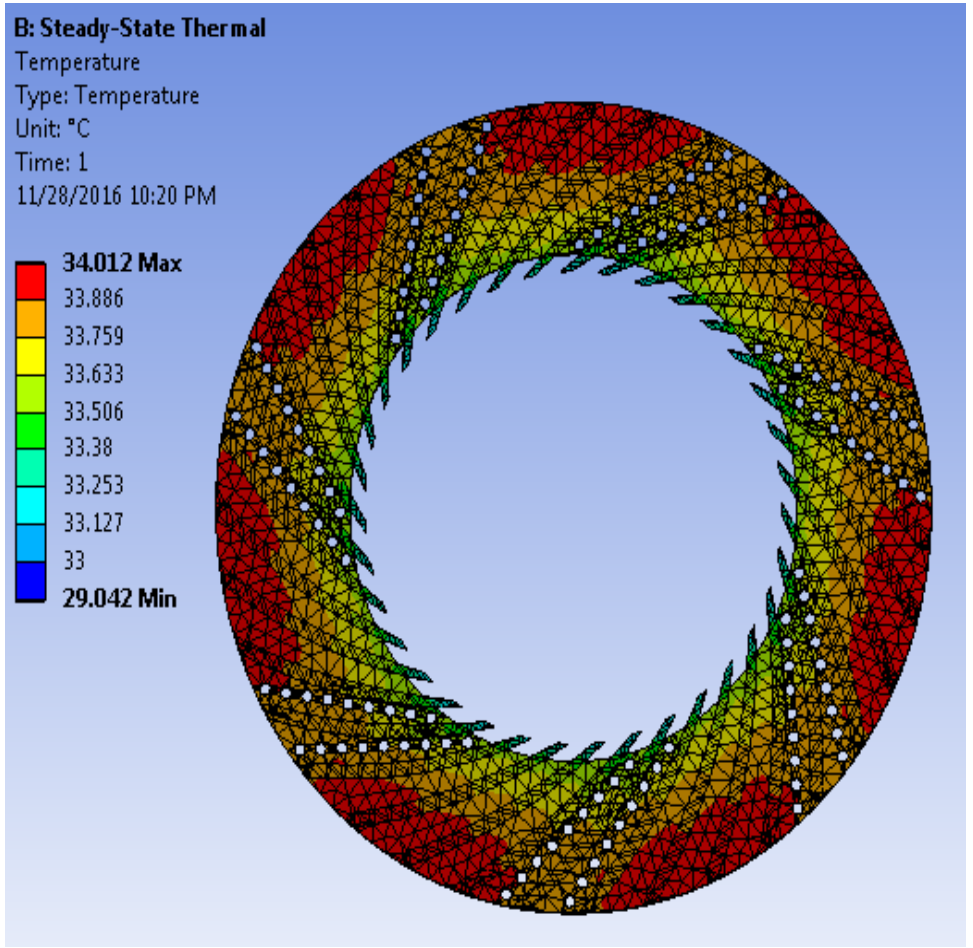


Steady State Thermal – Temperature Results

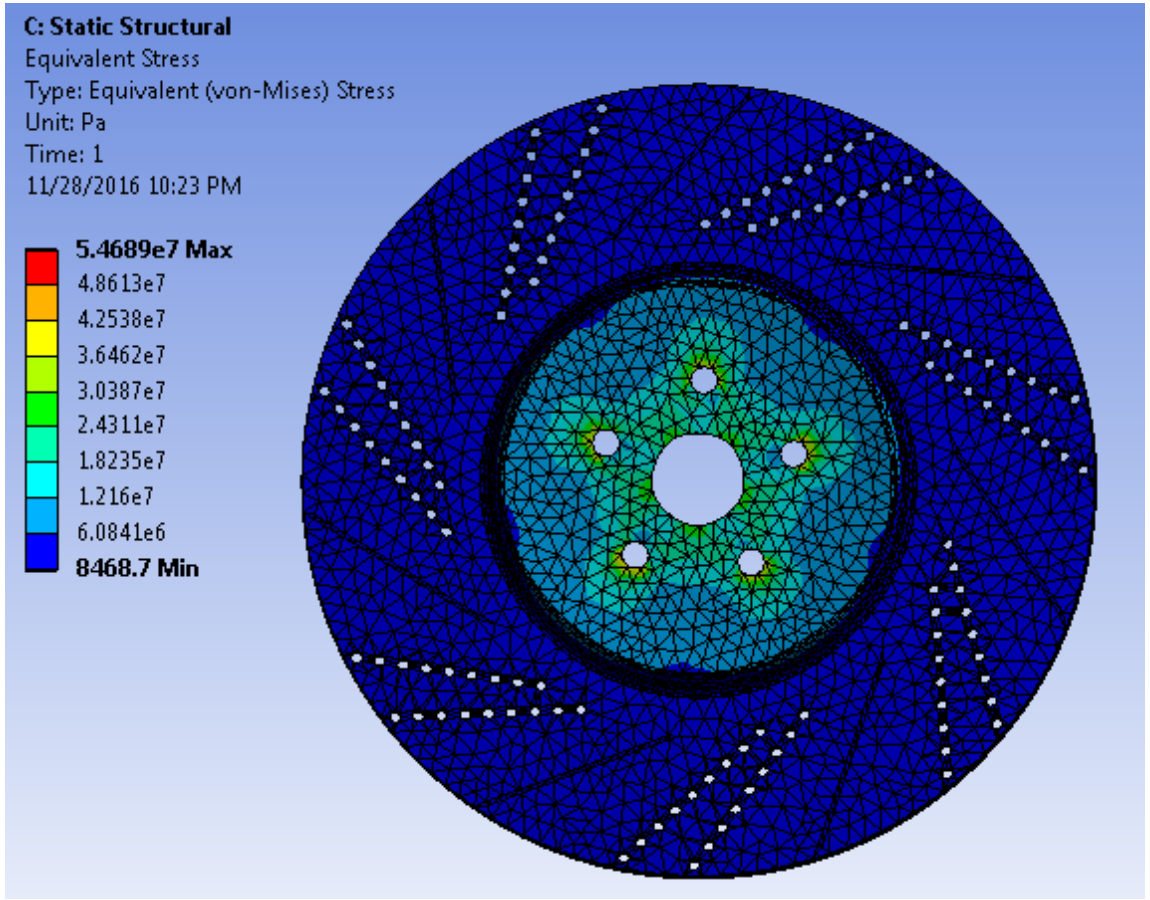
- Fixed at bolt holes, uniform heat flux on rotor faces, convection on all others
- Heat Flux = 1000 W/m^2
- Convective film coefficient of 30 W/(C*m^2)
- Ambient Temperature of 22 C

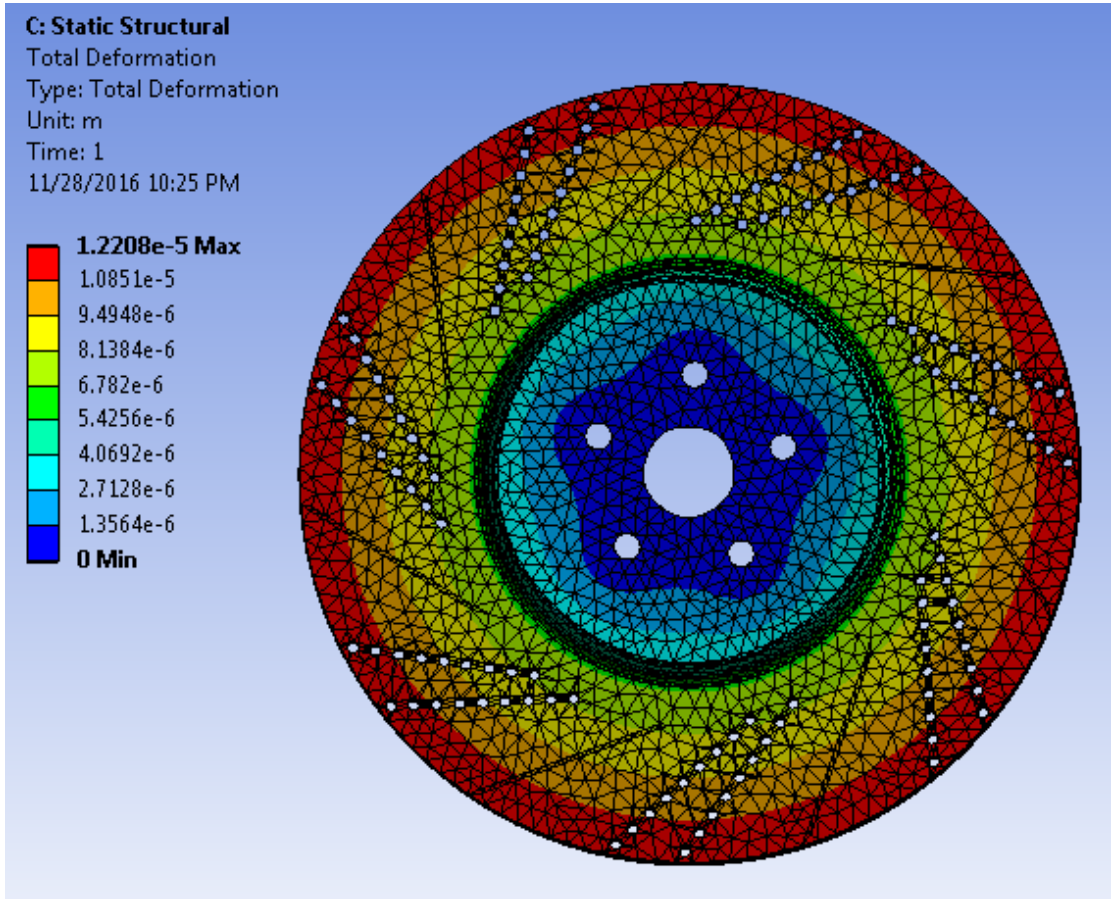
Steady State Thermal – Temperature Results





Steady State Thermal – Thermal Stress Results



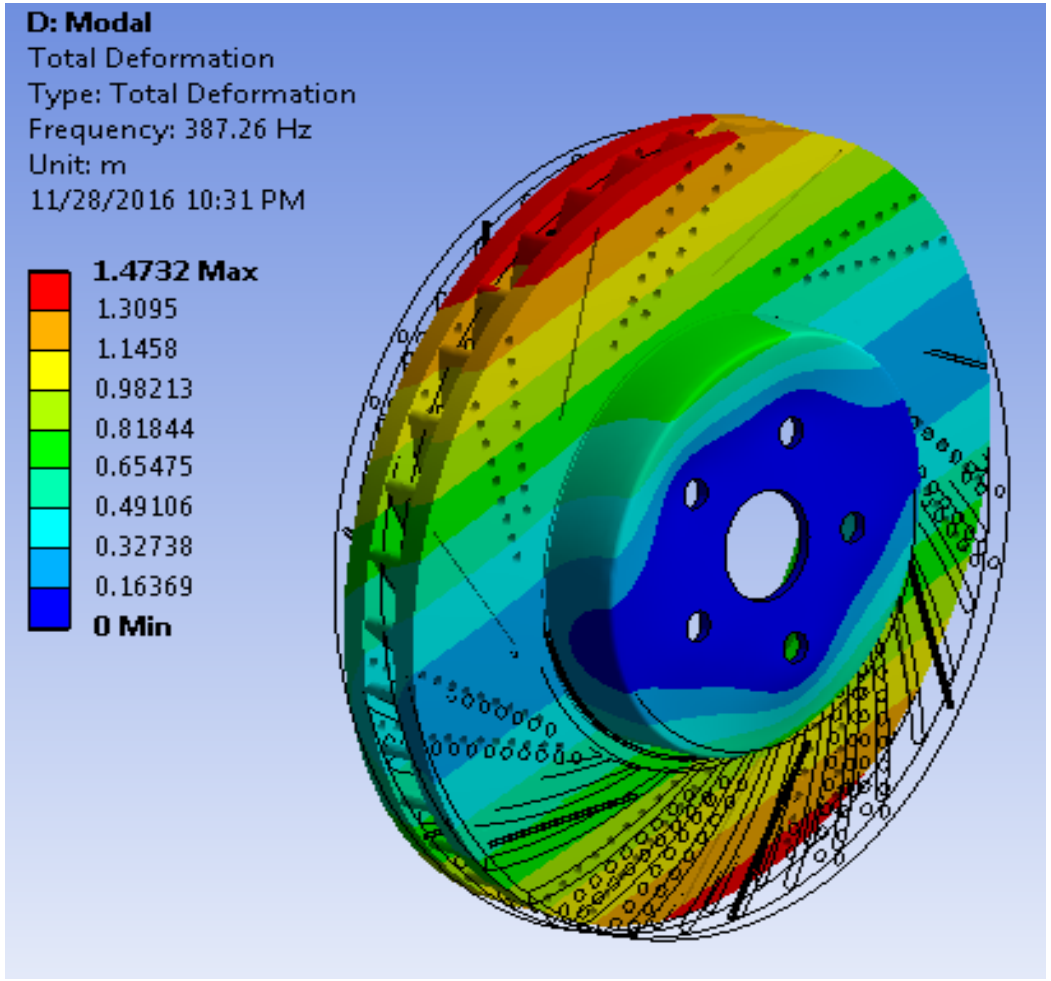


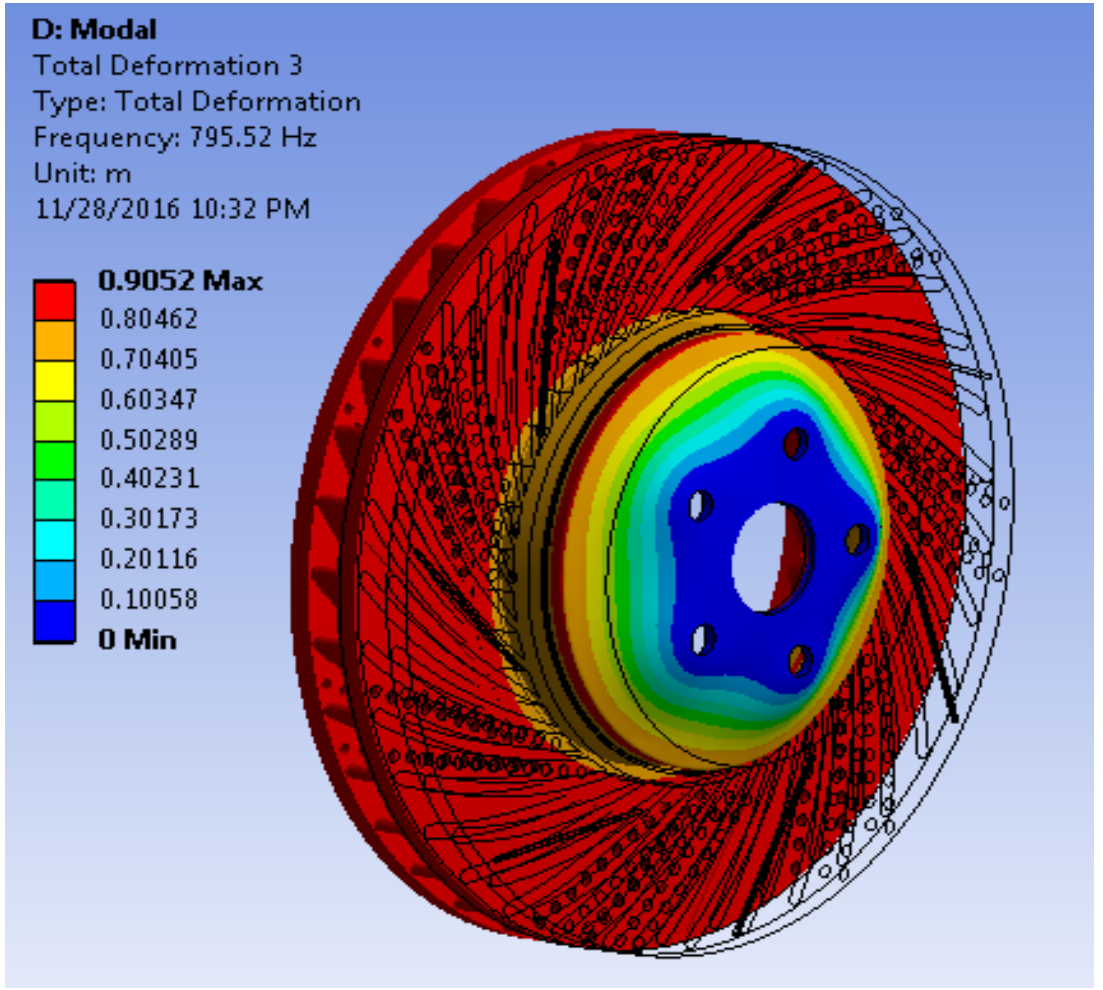
Modal Analysis - Results

- Mode shapes as well as modal frequencies were analyzed
- Fixed support on bolt holes
- First 6 modes were analyzed
- Modes 1 and 2 as well as 5 and 6 are repeated

Mode	Freq (Hz)
1	387.26
2	387.9
3	795.52
4	2142.4
5	2161.2
6	2161.9

Modal Analysis - Results





Modal Analysis - Results