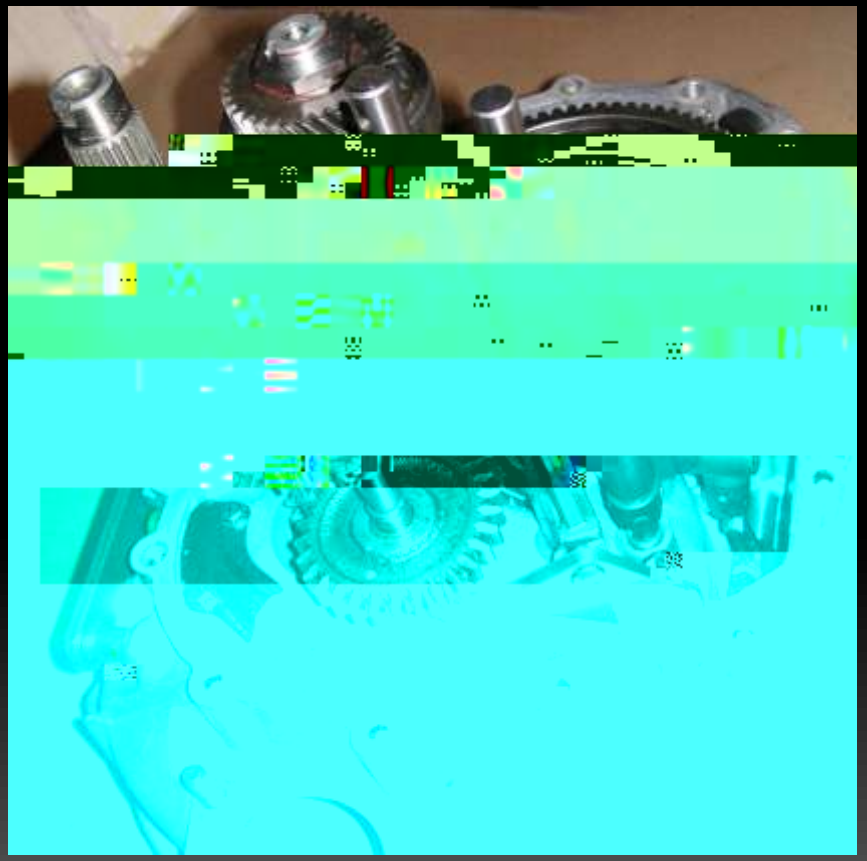
INTERACTIONS BETWEEN

Overview

- What is the purpose of a gear system?
- What is an involute spur gear?
- Why we use the involute spur gear?
- Look at new software SolidWorks
  - Advantages / limitations
- Stress/Strain analysis
  - Von Mises Stress
  - Displacement
  - Factor of Safety
- Conclusion
- Future Work

Purpose of a gear system?

- Transmitting power and uniform rotary motion to output shaft and differential
- $P = \tau \omega$
- Trade off τ for ω
  - Fast in 4th gear : high angular velocity
  - Fast in 1st gear : high torque



Why use an Involute Gear?

- Contact surfaces are always perpendicular to the plane of contact, reduces torque variation
- Smoother running and less wear on gears
- Ease of manufacturing accurate gear

SolidWorks

- CAD software with analysis features – FEA

A look at the interface

Limitations of student version

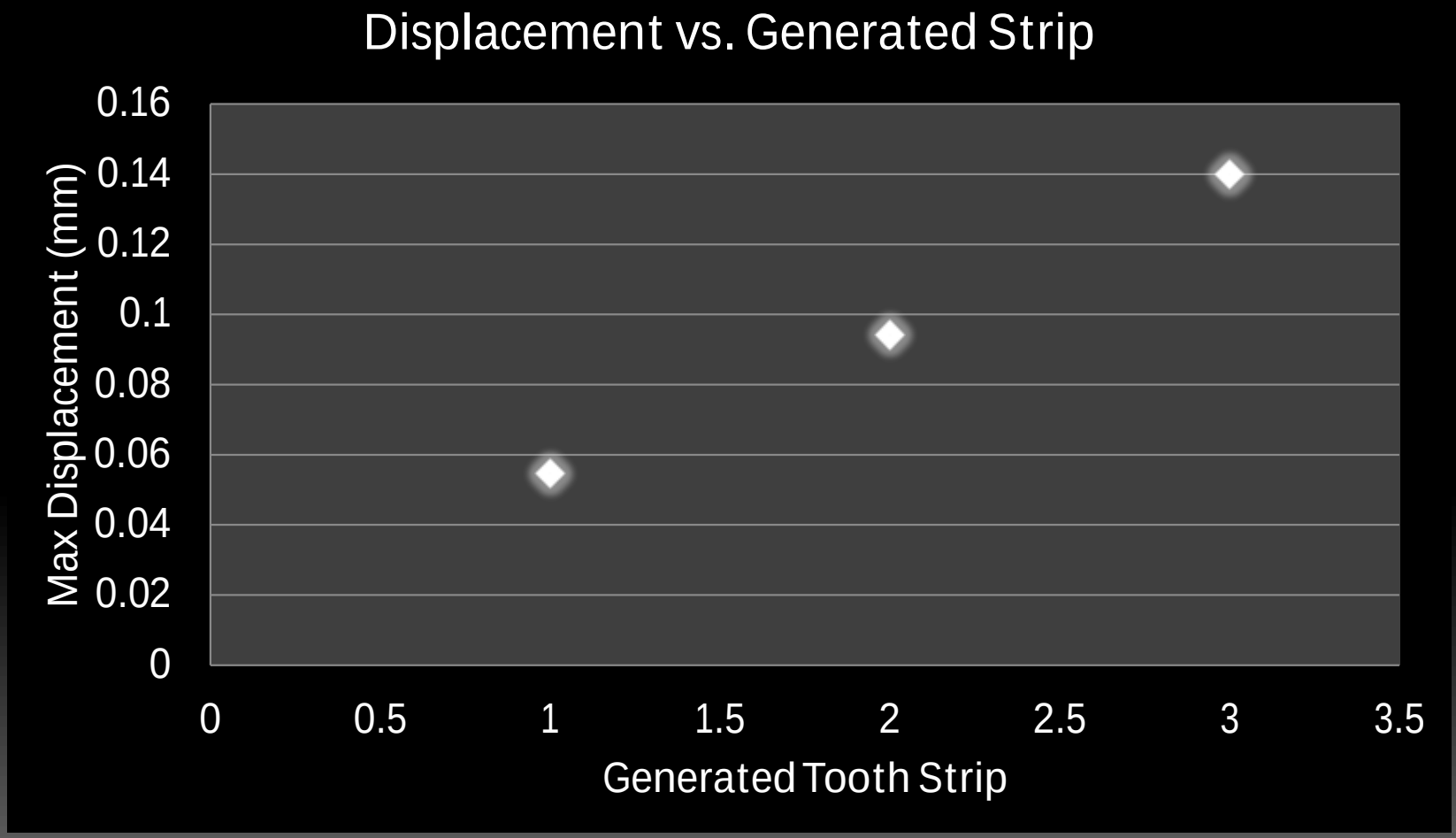
Power Comparisons

- 1 hp = 746 W
- Cars : 100’s of hp = 74,600 Watts
- Train : 1340 hp = 1 Mega Watt
- Turbojets : Thousands of hp = Few Mega Watts

Our Values

- Power : 2 Mega watts
- Torque : 15000 in-lbf
- ω = 1345 rad/sec
- Gear Radii : 2 inches
- Force : 34000 N
- Gear material : 1080 Alloy Steel
  - Young's Modulus : 2.1 x10 ^{11} N/m^2
  - Yield Strength : 6.20 x10^8 N/m^2

How does the displacement vary with change in contact position?



Von Mises Stress

- Formulated by James Maxwell in 1865
- Used in the analysis of ductile materials such as metals
- Used to compare yielding of materials to loading conditions
- Local magnitude of stress not (x,y,z)plane stress

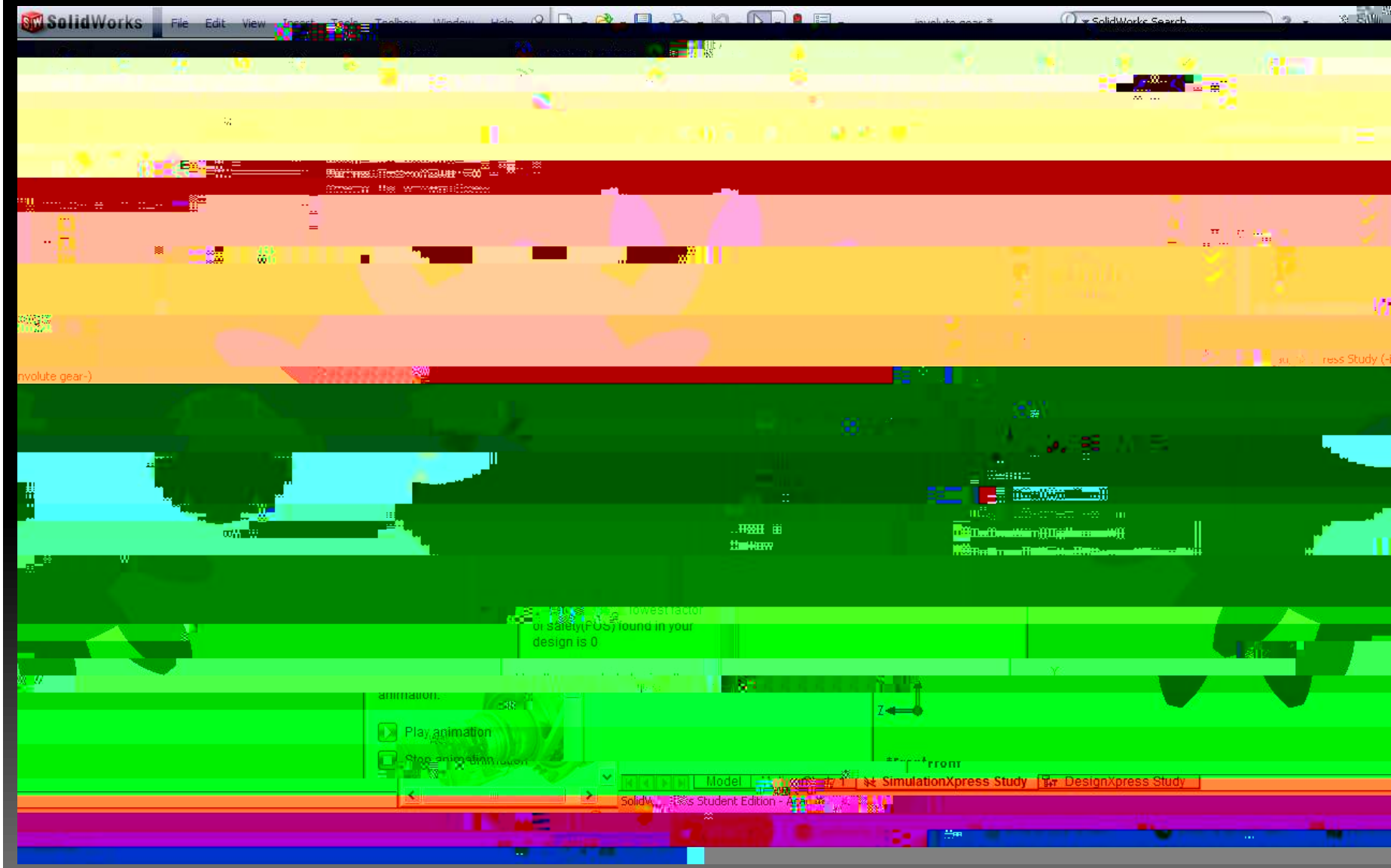
Von Mises Stress Results

Factor of Safety (FOS)

- Used in design process to determine uncertainty of material failure
  - Design calculations
  - Material strength
  - Purpose

Our case FOS range from 4-6

Factor of Safety Results



Conclusion

Future Work

- Examine different type of gear
  - Helical
- Lubrication Analysis
- Thermal Analysis
  - Shaft / Bearing friction
  - Inter gear friction
  - Heat dissipation within system

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Works Cited

- Raymond A. Serway.