

INTERACTIONS BETWEEN

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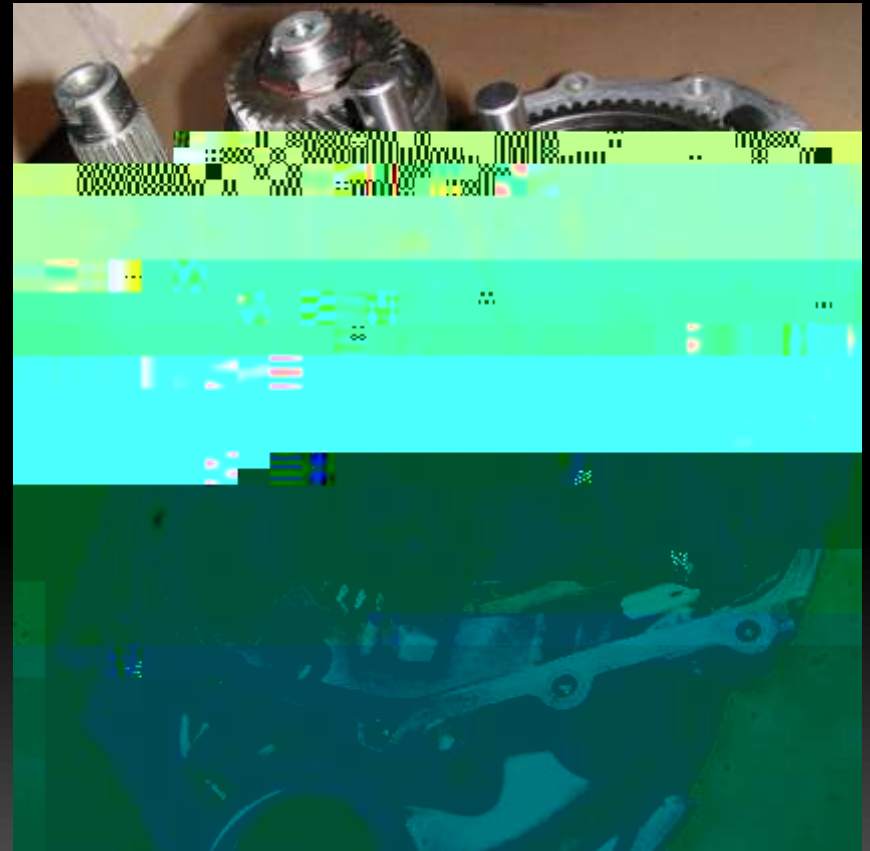


Overview

- 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
- $P =$
- Trade off for
 - 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
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A look at the interface



Limitations of student version





Power Comparisons

- $1 \text{ hp} = 746 \text{ W}$
- Cars : 100's of hp = 74,600 Watts
- Train : 1340 hp = 1 Mega Watt
- Turbojets : Thousands of hp = Few Mega Watts

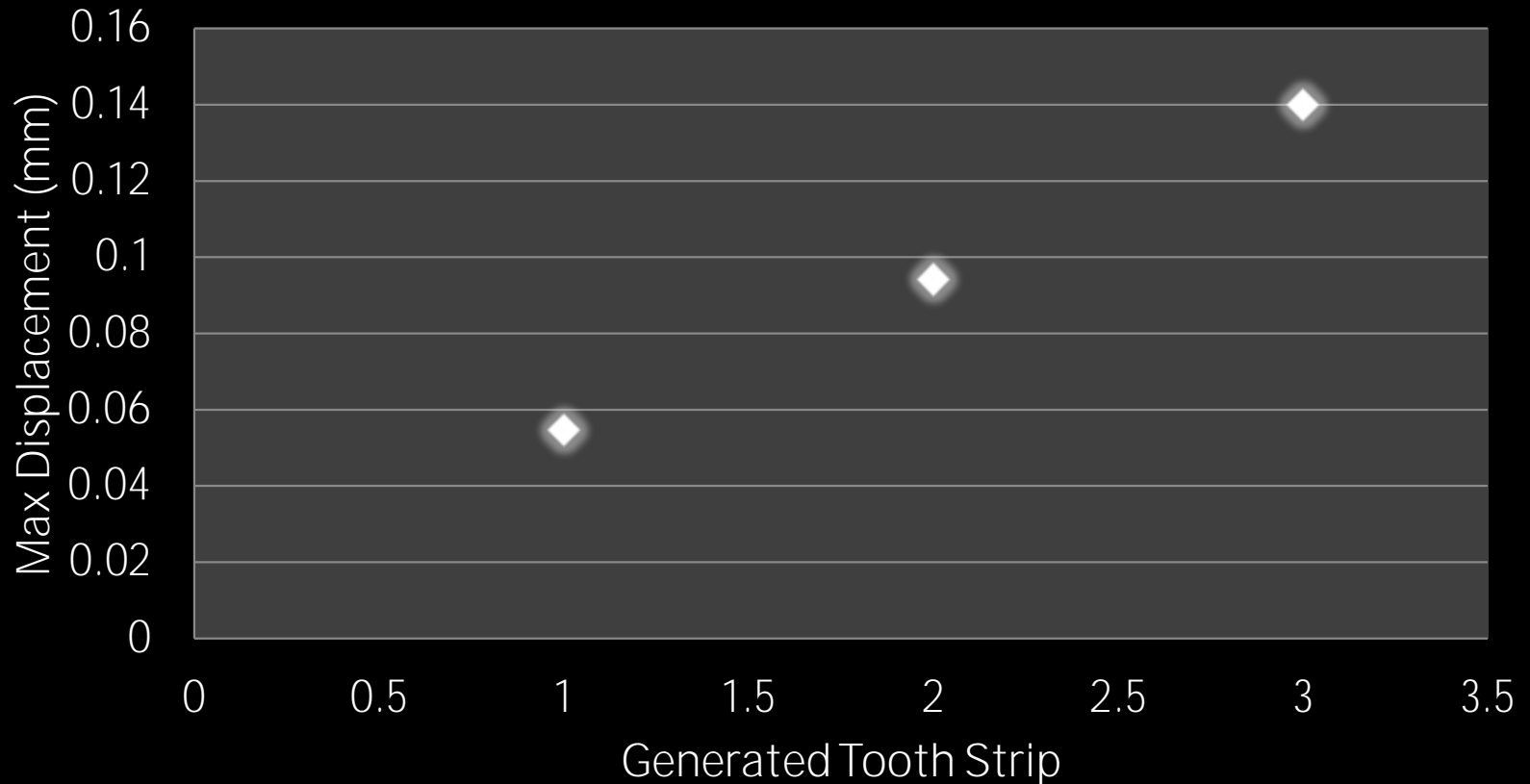
Our Values

- Power : 2 Mega watts
- Torque : 15000 in-lbf
- = 1345 rad/sec
- Gear Radii : 2 inches
- Force : 34000 N
- Gear material : 1080 Alloy Steel
 - Young's Modulus : 2.1×10^{11} N/m²
 - Yield Strength : 6.20×10^8 N/m²



How does the displacement vary with change in contact position?

Displacement vs. Generated Strip



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.

