

Senior Design Project Description

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| Company Name | GKN Driveline – Newton, NC | Date Submitted | July 13,2017 |
| Project Title | Gear Cutting and Grinding Optimization (GKN_GEAR) | Planned Starting Semester | Fall 2017 |

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.

Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

| Discipline | Number | Discipline | Number |
|----------------------------------|---------------|-------------------|---------------|
| Mechanical | 3 | Electrical | |
| Computer | | Systems | |
| Other (D.O.E. & Metallurgical) | 2 | | |

Project Overview:

GKN Driveline is a Tier 1 automotive supplier and designs and manufactures driveline components for many of the global leaders in automobile production. Starting out with forged gear blanks, GKN machines and finishes gears which are then assembled into driveline assemblies. The below picture shows a cutaway of a typical assembly:



The following are examples of the types of gears and gear sets that would be part of the project investigation:



Initial Project Requirements:

Mass producing precision gear sets is quite complex. There are many decisions that have to be made concerning variables that affect the final cost and quality of the finished product. Some examples include:

- Machine variables such as feed rate, rotation rate and coolant selection,
- Cutting tool variables such as material composition and hardness, cut angles, and selection of refresh grinding rates.
- Regrinding process variables such as grinding material, frequency of change, feed/speed rates and coolant usage

The objective of this project will be to seek improvements in the gear manufacturing process so that application of the improvements will result in reduced defect levels in the final driveline assembly.

Students will work with the supporter on particular gear set designs and baseline the current machining process decisions made from the many available options to produce that particular gear set model. The students will review the process variable selections with the supporter and determine which variables are the most interesting (meaning have the highest potential payoff, if a better variable selection can be found) and design experiments to measure the effect of a potential different choice in process variable characteristics. The students will run the experiments and



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measure results to see if they can identify new machining processes that will yield improvements in final assembly cost and or gear manufacture cost. During the project, the students will also do a literature search to determine if there are other technology ideas which can be trialed in the experiments being run.

Expected Deliverables/Results:

- Results of Literature search for generation of new ideas to try in gear machining
- Design of Experiments for several experiments which have the goal to define improvements in gear machining techniques
- Results of running the experiments and recommendations for implementation for further pilot testing, further investigation or production incorporation.

Disposition of Deliverables at the End of the Project:

Hardware produced should be returned to the Sponsor at the conclusion of the May Expo

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):

- Current GKN intern Tanner Sponhouse and Cameron Kinney to be part of team
- Design of Experiments will be a needed skill on the project, so completion of SEGR 4141 (Engineering Experimental Design) or equivalent would be beneficial. Faculty mentor support in this area could also be used to meet this need.
- Metallurgical knowledge will be very useful
- Experiments and testing will be conducted at the GKN Driveline site in Newton NC, so travel to the site by ALL team members is required. Design reviews may be requested to be held at the Supporters location as well.