PURDUE UNIVERSITY

CAPSTONE EXPERIENCE 2015

Continuously Variable Transmission

Agricultural & Biological ENGINEERING

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Project Overview:

The team decided to choose the CVT/IVT demonstrator unit and lesson plan.

Problem: The need for further educating students on CVT transmissions was discovered, as they are a new feat in todays agriculture. The team's goal was to outline the different results of using a continuously variable transmission, the many different power channels, moving internals, and thus create a lesson plan to teach future students more about these transmissions. Along with this, a working model was established to illustrate the functionality, ins, and outs of a CVT transmission. Due to the teams past experiences with CNH Industrial, centralization was set around the CVT transmission. This is the same transmission that the team had the opportunity to work with all summer long. The problem at hand was that the ASM program indicated a need for not only a model demonstrator, but also for a more detailed lesson for CVT transmissions. CVT transmissions are very intricate, consisting of many small and large moving parts. It has been decided that the best way to illustrate this is to outline the power channels and basic principles using a small scale model with an incorporated lesson. In summary, the team's main goal was to successfully construct a full PowerPoint lesson with a working CVT model in order to better educate both current and future students and staff.

Project Economics:

Due to the low cost of this project, the team has discovered a huge return on income. So much of personal time has been sacrificed to sift through endless amounts of materials from sources to create a lesson on CVT's. The only investment the team has made is time, and time is very low cost. In retrospect, the return is much greater. The return is benefit that many future student will have from being further educated on CVT's.

Tools:

This project did not require the use of any hard tools, however, it did require the use of many soft tools. Soft tools are defined as computer programs such as word to write our reports, excel to develop an expense report for the project in progress reports, and Microsoft PowerPoint in the final product design.

CVT Lesson Outline:

1)Key Features
- a)All components of the CVT trans
- b)All abbreviations associated with these components

2)CVT Trans/Hydro
- a)Hydro Unit
  - i)Achieving fixed engine output
  - ii)Swash Plate Angle
  - iii)Results achieved

3)Operation Modes
- a)Illustration Chart
- b)Inching pedal

4)Transmission Layout
- a)Range Clutches
- b)Reverse Clutch
  - i) Input Speed Sensor
  - ii)Compound Planetary
  - iii)Input Sun Gear
  - iv)Forward and Reverse Clutch

5)Compound Planetary
- a)Input Sun
- b)Output Sun
- c)Planetaries

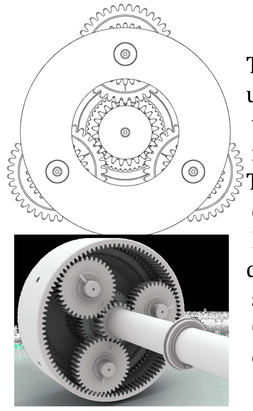
6)Functionality
- a)Park
- b)Forward Ranges 1-4
- c)Reverse Ranges 1-3.

Alternative Solutions and Finalization:

The original plan was to locate a full sized transmission to use as our demonstrator. Budgets and transportation plans to get the transmission from Wisconsin to Indiana had already been made. However, the team was not able to find a salvageable transmission to use. After discovering this, it was decided that the team go with plan B, which was utilize networking skills through CNH to find small scale models. This was a success, and two models were obtained to allocate to classroom needs.

Applying Principles:

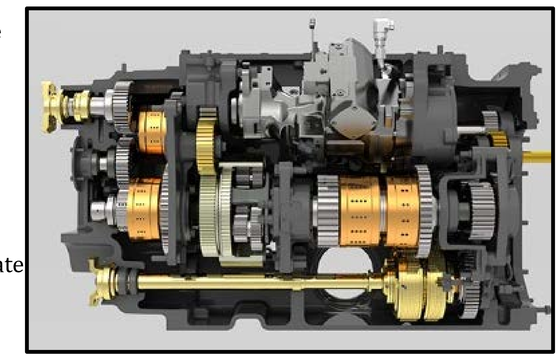
Throughout this project, the team encountered situations that required use of principles and methods that are often taught in Agricultural Systems Management and Engineering. Through ASM, team members have taken several agricultural economics classes that place a huge emphasis on establishing a network. Examples have already been provided as to how The use of networking skills helped to establish relationships with people of high power. In this particular instance, spending time with CNH Industrial to acquire information on CVT's and the small scale models. This can be extremely beneficial in a project like this. This project presented the group with a specific problem and pushed the use of an engineer's approach to solving this problem by brainstorming, providing solutions, providing alternative solutions, deciding whether or not our solutions are feasible, choosing a sufficient solution, and developing a series of steps to successfully solve the problem at hand. From a managerial stand point, the team has taken it upon themselves to develop leadership, and break the project up into separate parts for the times that not everyone can be working on one specific part simultaneously. As a manager, one is expected to "take the bull by the horns" and develop group roles. They are in charge of their project and accepting full responsibility.



Final Design:

The final design is a full PowerPoint lesson to be used in the ABE department which covers CVT transmission basics. It is intended to be used in future classes and labs.

The outline to the left describes topics that are covered in this particular lesson. The PowerPoint consists of about 40 slides with detailed pictures and information. In addition, several videos have been included to demonstrate CVT functions during field use with detailed explanation.



Positive Impact and Sustainability:

In completion of this project, the team hopes to have a positive impact not only on professors, but also on fellow peers and future students. By developing this demonstrator, a learning opportunity for those around us is being provided. As mentioned earlier, CVT transmissions are very complicated and unique. Many manufacturers in the industries of agriculture and Automobiles are pushing towards the new CVT and IVT transmissions in the majority of their equipment. As the future of farming nears, society will begin to see more and more of these. The world is leaning more towards fuel economy and efficient power use, both which are achieved by the CVT transmission. At some point, the power shift transmission may be an aspect of the past. It is then important for future farmers, technicians, and ASM graduates to have a better understanding of the Continuously Variable Transmission. The team hopes that this project impacts not only today's ASM students, but also tomorrow's.

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