Project Name – Centrifugal Pump Applications

Overview
The problem we were presented was to model an oil pipeline, two gate valves, a centrifugal pump, and a three phase induction machine with a variable speed drive controlling it. The model had to describe pump performance and fluid parameters while leaving viscosity, density, flow rate, motor efficiency, and impeller wear variable with a controller. The program would calculate the best possible point of operation and display numerous values to a screen as a tool for an operator or for marketing pipeline products to customers.

Objectives
The objective was to create a simulation of the pipeline discussed above. This was accomplished by creating a program using Siemens software, designing and creating a controller, and interfacing our program with our partner team’s program to produce the desired result.

Approach
- We began determining customer requirements by discussing them with our sponsor in person.
- Studying physical properties encountered on a pipeline
- We defined a set of mathematical equations and correction factors that were relevant for simulation
- Concept generation for a controller for variables based on customer requirements
- Created CAD models of schematics, physical components, and a physical description of the system.
- Fabricating a frame for enhanced organization/testing/presenting
- Programming and testing for head losses throughout the length of pipe
- Programming and testing for proper pump parameters for water at 27250 gpm
- Programming and testing for correction factors for varied viscosity, density, and flow rate.
- Programming a Human Machine Interface for display of variables, and ensuring that values were correct
- Integrating our program with partner team’s and testing for correct outcomes required by sponsor.
- Comparing results with manufacturers pump curves, and sponsors values.

Outcomes
- This is an extremely useful marketing tool for Siemens
- Creates a virtual test bench for new technology on a pipeline
- Being able to monitor pump efficiency allows Siemens to save customers millions of dollars and create solutions to improve efficiency, creating a positive economic and environmental impact.
- Eliminates need to erect a physical model to describe pipeline parameters