Water Flow Indicator Simulation and Design

Overview
Johnson Controls International has tasked the PSU JC Team with creating and verifying a simulation of a water flow indicator. The water flow indicator inserts a rubber sheet into a pipe to detect if water is flowing. The purpose of the simulation is to model the deformation of the rubber sheet in the flow field, so the system can be modified.

Objectives
The PSU JC Team has been tasked with the following:

- Creating a coupled simulation of the rubber sheet in a pipe flow field.
- Verifying the simulation using theoretical and/or experimental techniques.
- Optimization of the water flow indicator system.

Approach
- Background information was gathered through interviews with the SJTU team and Johnson Controls engineers.
- Several MATLAB codes with different assumptions were used to theoretically solve the problem.
- Laminar and turbulent pipe flow models were created and compared to the theoretical solution.
- A ‘defeatured’ CAD model was created in Solid Works.
- A static deflection model was created and verified with the deflection codes.
- A coupled model was created and checked against the theoretical solution.

Outcomes
- An initial coupled model for the deformation was created. This model can easily be changed for different flow rates and pipe sizes.
- The final codes for the theoretical solution were created.
- Johnson Controls can use this simulation to gain a better understanding of the system so it can be optimized.