Progress Report 9: November 10th to November 16th, 2008

Centrifugal Pump Design for Neuroendoscopy

Client: Dr. Joshua Medow, MD, Dept. of Neurological Surgery
Advisor: Professor William Murphy, Biomedical Engineering
Team Members: Jenna Spaeth (Leader)
Kellen Sheedy (Communicator)
Laura Piechura (BWIG)
Holly Liske (BSAC)

Problem Statement

Neuroendoscopy is a surgical procedure that uses endoscopes or tube-like instruments to view the internal surface of the brain. A continuous (non-peristaltic) flow of saline is necessary to visualize and navigate throughout the surgical field. If not maintained, variable saline pressures may lead to flooding of the brain or visibility issues with the endoscope lens. Currently, this continuous flow of saline is created through a pressurized bag of saline; however, due to lengthy procedures, the saline bags must be replaced frequently causing disruptions during the surgery. Our client, Dr. Joshua Medow, would like to use a centrifugal pump to control the constant flow of saline. The pump that has been chosen was originally designed for cardiac surgery, having a saline flow of 5.0 L/min, much higher than the 150-mL/min flow required for the rinsing the brain. Dr. Medow would like us to design the circuitry for the centrifugal pump as to create a negative feedback system to control the saline flow when instruments are inserted and removed from the endoscope during the procedure and to reduce the overall flow rate to the appropriate level.

Last Week's Goals

- Measure transient response of the system to define potential limitations
- Collect specifications for designing a comparator and summing amplifier
- Create list of components needed and acquire them
- Start building the circuit in the 310 lab with the hope of transitioning it to the real system the following week
- Start modifying the PDS to match design choice

Summary of Accomplishments

- On Friday, Nov. 7th our team met on the 2nd floor of ECB to continue acquiring the components necessary to build the comparator design. Laura and Jenna both researched the schematics for a summing amplifier and a comparator, the two more complex circuit elements we intended on building from scratch. It was at this time we all started to understand the complexity and uncertainty associated with the comparator design and it was decided to consider a more simplistic and effective design option. The new design proposed is very similar to the original differential amplifier design, but incorporates a summing amplifier. The purpose of the summing amplifier is to take the difference between the sensor voltage and the control voltage (from the differential op amp) and add to it the value of the control voltage. This way, when the circuit loops, the summing amplifier is feeding the appropriate voltage back to the sensor, not just the difference in voltage the sensor needs to make up. It was decided to move forward with the investigation of this design.
- On Wednesday, Nov. 12th our team met in the BME 310 lab to build the circuit and test the output voltage values using Lab View. Due to time constraints, this process was not able to be completed and will continue the evening of Thursday, Nov. 13th with the guidance of Amit. If successful, our next step is to transport the circuit to the VA lab and test it with the pump system (11/17).
- Transient response of the system has not be tested yet, but will be down within the next week

The Week's Goals

- Measure transient response of the system to define potential limitations (11/17)
- Test circuit in BME 310 lab using Lab View to verify predicted output voltages (11/13)
- Transport circuit to the VA lab and test with the pump system (11/17)
- Confirm potentiometer and resistor values that create an optimal operating system
- Start modifying the PDS to match design choice
- Start writing final report

Project Difficulties

We had difficulty coordinating the Lab View system with the external circuit board that housed our circuit.

Activities

Team Member	Activities
Holly	11/7 Meeting, 11/12 meeting
Jenna	Progress Report, 11/7 Meeting, 11/12 meeting
Kellen	Communication with client, advisor & Amit, 11/12 meeting
Laura	11/7 Meeting, 11/12 meeting

Project Timeline