Testing System for Pressure Sensitive Cardiovascular Catheter

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Design Team

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Overview

- Problem Statement
- Background material
- Product Design Specifications/Client Requirements
- Three design alternatives, explanation and analysis
- Future work
Problem Statement

- Pressure sensitive cardiovascular catheters are being used to verify a new blood pressure monitoring technology.
- The three pressure sensors on the catheter are not recording the same pressure.
- Need a system to verify accuracy of sensors or diagnose a problem.
Previous Work

- Pressure calibration procedure
- Tubular device
  - Sphygmomanometer induced pressure

Problems:
- Maintaining constant pressure
- Leaking saline
Client Requirements

- Testing system for catheter calibration
- Test at range of pressures
  - Atmospheric
  - Saline
  - Increments of 50 mmHg
- Controllable saline range
- Stable/constant calibration values
  - 2% allowable error
  - 200 mmHg max
- Short amount of time
- Sterility
- Inexpensive
Alternative #1: Rotating Cylinder Design

Various Size Weights

Saline Filled Tank

Catheter
Alternative #1: Rotating Cylinder Plunging Mechanism

Weight Selected

Plunger Head

When user selects weight, release rod retracts into cylinder, causing the weight to fall

Our Pressure Sensor

Catheter Sensor
Alternative #1: Rotating Cylinder Design

Pros
- User control over process
- Catheter sensor close to ours
- Fairly small size
- Neat/Clean Design
- Removable Saline

Cons
- Cost
- Time to Program
- Fabrication
- Saline contact
  - membrane instead of foam?
Alternative #2: Balloon Design

- Air tight container
- Balloon fills, increases pressure inside tank
- Pressure sensor regulates air pump
Alternative #2: Balloon Design

- **Pros**
  - Simplicity
  - Saline easily removed for storage
  - Many components already fabricated
  - Simple geometry for machining
  - May or May not be automated depending on client preference

- **Cons**
  - Gas/Liquid interface
  - Requires air/water tight seal
  - Automation may require additional computer program
  - Cost of automation
Alternative #3: Plunger Design

1. Filling port
2. Saline filled catheter chamber
3. Membrane
4. Air filled chamber
5. Piston Head Attached to LA
Alternative #3: Plunger Design

- Pressure Sensor in Saline Solution
- Amplifier Circuit
- A/D Conversion
- PC Controller
- Linear Actuator
- Changes Pressure
- User Input: Desired pressure
Alternative #3: Plunger Design

Pros

- Simple
- Repeatable
- Easily automated
- Allows for user control

Cons

- Requires air/water tight seal
- Moving components
- Difficult machining
Future Work

- Decide on specific design
  - Specifics within design (e.g. automation)
- Build prototype system
- Design calibration method
- Test system and calibration method
Questions?