Example Projects - BIOEN 440 / ME 445 - Spring 2016

1. Device Powered by Motor Proteins

Motor proteins (e.g., myosin) are essentially proteins that convert chemical energy into mechanical work by the hydrolysis of ATP in order to move along a surface. For this project, you will design a device (e.g., drug delivery microdevice) that utilizes motor proteins.

2. Artificial Cell Design using Tensegrity Principles

Tensegrity is a structural principle characterized by elements that are tensioned or compressed, but not both. For a cell, this typically describes the actin filaments/intermediate filaments and microtubules, respectively. For this project, you will design an artificial cellular membrane based on the principles of tensegrity.

3. Theoretical Model Verification using Experimental Data

One challenge in mathematical modeling of physical phenomena is model verification. For this project, you will verify (or nullify) different mathematical models using a single biomechanical dataset found in a paper.

4. Soft Tissue Analysis

Soft tissue is ubiquitous in the human body (e.g, tendons, ligaments, skin, liver, lung, etc.). The goal of this project is to choose one soft tissue and review it's mechanics using results from published clinical journals.

5. Heterogeneous Phantom Model

A phantom model is human body model realized as a computational simulation. In this project you will use simulation tools, and mathematical modeling to design a phantom model and evaluate the mechanical properties of the model.

6. Ultrasound for Hepatic Fibrosis

Hepatic fibrosis is a liver disease characterized by excessive connective tissue. In this project you will review the state-of-the-art techniques for ultrasound of hepatic fibrosis.

7. Passive Dynamic Walker

Passive dynamics walkers are mechanical devices that can walk stably down a slope. They have no motors, but exhibit remarkably human like gaits. For this project, you will design a passive dynamic walker and model the device in simulation.

8. Parkinson's Stabilizing Spoon

Parkinson’s disease affects the motor system and results in uncontrolled tremors. For this project design an active spoon device that can effectively cancel the tremor vibrations of the hand.

9. Active Lower Limb Prosthetic Device

A prosthesis is a device that replaces a missing limb. For this project you will design a prosthetic lower limb device including the mechanical system and sensor system needed to control the device.