**Short Title:**

Disk-on-disk System

**Descriptive Title:**

Design, manufacture and control of disk-on-disk experimental apparatus.

**Supervisors:**

Joel Ferguson

**Student Name and Number:**

Timothy Dunn C3234207

**Project Description / Background:**

The disk on disk system is a classical underactuated mechanical system comprised on a single driven disk which is manipulated to stabilize a freely rotating disk. The scope of this project is to design, build and control a disk on disk experimental apparatus.

Complicating the implementation is the use of a camera for the freely rotating disk state measurements. Sensor models for the camera will be investigated and the hardware characterized. Once completed, the camera can be used in conjunction with an appropriate control law to achieve closed-loop stability.

**Aim:**

Build and control a disk on disk system

**Objectives:**

1. Construct a numerical simulation of the system and implement an MPC control.
2. Design and build a disk-on-disk experimental apparatus.
3. Develop a camera sensor model to identify the location of the free spinning disk.
4. Implement MPC control on the physical hardware.
5. Implement nonlinear observer for the velocities / momentum.
6. Implement energy-based control method with integral action in hardware.

**Resources needed:**

Standard pc workstation.

Approx 2m2 of Perspex, most likely laser cut by workshop (2 disks and 2 rectangular sheets). Manufacture of other smaller frame components for apparatus. DC motor and rotary encoder, camera for machine vision. STM32 microcontroller.

**Anticipated Risks during project**: Minimal risk. Moving parts in system with pinch points. Low voltage electricity. Low power motor to be used. LiPo battery most likely to be used.

**Grade expectations**:

High D / Low HD