Appendix: Locomotive Crankshaft Setup and Operational Procedure

Materials:

- 1 - 7-11 VDC, 5 A regulated power supply
- 2 - Rulers
- 1 - Locomotive crankshaft with MyDAQ device

The hardware will be setup in advance by the lab manager and assistants. You can use the following setup procedure to verify or troubleshoot the connections if necessary.

Setup Procedure:

1. Plug the NI cable from the MyDAQ into the USB port on the computer
2. Open the NIMax software:
   (a) Under devices and interfaces:
   Verify the NI MyDAQ is listed as **MyDAQ 1**, if not rename it
3. Power the locomotive crankshaft motor:
   (a) Set the power supply voltage knob to 0V
   (b) Plug the red banana connector (labeled **MOTOR V+**) to the positive terminal of the power supply. This powers the motor of the locomotive crankshaft
   (c) Plug the black banana connector (labeled **MOTOR V-**) to the negative terminal of the power supply
   (d) Verify the current limit is set to 5A
   (e) Do not power the locomotive motor just yet

Note: Motor voltage polarity determines direction, be careful that your crank is always going counter-clockwise.

Operational Procedure:

1. Open `Locomotive_NewDerivative.vi`. You can find the shortcut in the ASEN 2003 folder
2. Measure r, l, and d
3. Measure the vertical displacement of the slide by subtracting the lowest position from the highest in units of (mm). Record in your lab notebook.
4. **Before starting the VI, set the collar to the minimum (lowest) position by hand.** This step is important. The VI calculates θ by assuming that you always start at this position of the wheel (approximately 152.5°).
5. Start running the VI by clicking the play button. At this point the VI is not logging data to a file yet.
6. Turn the wheel 360° counter clockwise to do a verification check that the wheel position box reads approximately 512.5° (360° + 152.5°)
7. With the potentiomeer calibration box set to 1 mm/V, the program will display the raw measurement in volts. Record the slide position from plot 2 (slide position) at its highest and lowest point in Volts.
8. Use the displacement data in step 3 as well as the calibration data in step 7 to calculate the new potentiometer calibration in mm/V. (This should be between 48-51 mm/V)
9. Stop the VI, select cancel and lose data when prompted to save

10. **Before starting the VI, set the slide collar to the minimum (lowest) position by hand.**
11. Enter the new potentiometer calibration value from step 8 and restart the VI
12. Begin turning the crank by raising the voltage of the power supply to the desired voltage setting. A voltage between 6-11V works well. **(DO NO EXCEED 11V!)**
13. Click the 'Begin Data Capture' button to start logging data. After 8-10 rotations, click the button again to stop logging data. The VI will then prompt you for a filename. For ease of analysis later in MATLAB, use the same data file naming convention as the sample data files:
    `Test#_xxptxxV`
    Where # is the trial number and xx is the voltage (ex. Test2_5pt6V)