ECSE 4460 Control Systems Design

Final Demonstration, Presentation, and Report

Instructor: Professor John T. Wen
TA: Rafael Quintanilla

http://www.cats.rpi.edu/~wenj/ECSE446S06/
Several Things

• NI Simulation Module
• Velocity estimation (for low speed)
• Using data from friction ID for model validation
• Amplifier gain calibration
NI Simulation Module

• At the advice of Andrew Watchorn (NI Sales Engineer), you should use blocks from the Simulation Module instead from the Control Module.
Velocity Estimation

For slow speed, it would be better to count the length of the encoder pulse (before transition)

\[ \rightarrow T \leftarrow \]

\[ A \quad \text{__________} \quad \text{__________} \]

\[ B \quad \text{__________} \quad \text{__________} \]

Separation between transitions: \( \frac{2\pi}{4096} \).
Estimated velocity: \( \dot{\theta} \approx \frac{2\pi}{4096T} \).

If sampling period is \( < T \), then output previous velocity value.

For high speed, count # of transitions in each sampling period as before.
Friction ID for Model Validation

Friction ID test not only provides estimates for friction coefficients, but the test data may be used for model validation as well.

Friction ID test: \( I \dot{\omega} + F_c \text{sgn}\omega + F_v \omega = \tau. \)

Solution: \( \omega = (1 - e^{\frac{F_v t}{I}})(\frac{\tau-F_c}{F_v}). \)

The transient may be used to estimate (or check) the inertia value.
Amplifier Calibration

For amplifier calibration:

- attach an ammeter in series with an inductive load (e.g., motor)
- program D/A to output different voltages
- Measure the corresponding current. To avoid back EMF, prevent motor from rotating. This may overheat the motor, so monitor the current to prevent excessive current flow.
- Adjust the potentiometer for different gains and offsets.
Final Demonstration (4/25)

To be held in CII 8208 next Tuesday (4/25) at 8:30am.

Final demonstration: each group has up to 20 minutes (including questions and answers).

Will be part of final presentation grade.

Send me a demo script by morning of Monday April 24:
  • Objective of the demo
  • Description of demo
Final Presentation (5/3)

Final presentation: each group has 25 minutes max (including questions and answers).

How you will be graded:

• Manner: voice, eye contact, gesture, movement, and explanations indicate that the presentation is well-rehearsed

• Organization:
  ▪ Main points are clear on the slides
  ▪ Spoken commentary clearly related to bullets on slides
  ▪ Transitions between slides are clear and easy to follow

• Engineering: Explanation of design spec and approach, present and analyze results

• Questions: Responses to questions are relevant and clear.
Suggested Outline

• Introduction (problem statement and motivation)
• Objective and specification
• Design approach (modeling, model validation, control design, design validation and tuning in simulation and experimentation, uncertainty analysis)
• Results: comparison between performance and specification (a video here would be great!)
• Overall assessment of accomplishments vs. objective
• Conclusion
Video Clip for Final Presentation

Recommendation:

• Record your demo (video camera, tripod, check out from Rafael)

• Upload raw footage via Firewire interface (use PCMCIA Firewire card, check out from Rafael).

• Edit the footage into a good short movie and incorporate into your presentation.
Final Presentation and Report (5/8)

Strive to tell a story: motivation, specification, approach (modeling, model identification and validation, linear design, nonlinear simulation, final tuning), results (compare achieved performance with original spec and nonlinear simulated performance, evaluation of design: step response, tracking, disturbance rejection, motor or amp near saturation?)

Sketch out an outline of the story first and then fill in the details.

Have writing center do a first level filtering of your writing.

More detailed guideline on-line
Final Report (5/8)

As part of the final report, put all your reports, presentations, video(s), codes, simulations, etc., on a CD or a zipped file.

Also hand in your lab notebook at the same time.
Final Report

• Organization:
  ▪ The point of each paragraph is stated in the first sentence of the paragraph.
  ▪ Forecasting words are used to tell readers what to expect in the coming paragraph(s).

• Visuals
  ▪ Each visual is clearly captioned.
  ▪ All components are labeled.
  ▪ The visual clearly relates to the written text.

• Main body
  ▪ Key questions are answered in each section.
  ▪ Questions are elaborated on with appropriate detail.
Final Report

- Standard English: grammar, usage, spelling, punctuation, sentence structure

All work must be carefully proofread to eliminate mistakes in these areas.
Tomorrow at 6pm in CII 8208

Progress Review

Group 1: 6pm
Group 2: 6:20pm
Group 3: 6:40pm
Group 4: 7:00pm
Group 5: 7:20pm