CBE470: Process Dynamics and Control
Experiment 1ABC: Matlab Workshop

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Abstract	/ 5	
Introduction	/ 5	
Results and Discussion		
1: Transfer function definition.	/ 4	
2: First-order parameters.	/ 4	
3: Second-order parameters.	/ 6	
4: Eigenvalues and importance.	/ 6	
5: Poles and zeros effects.	/ 6	
6: Impulse response.	/ 6	
7: Frequency response.	/ 6	
8: Padé approximations.	/ 6	
9: Lead/lag systems.	/ 6	
Conclusion	/ 5	
Appendices	/ 5	
Figures/Tables	/ 10	
General	/ 10	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 1D: Feedback Control with Matlab

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Plot Formatting	/ 4	
Individual Plots		
1: Poorly tuned step.	/ 1	
2: Well-tuned step.	/ 1	
3: FOPTD calibration.	/ 4	
4: Tuning comparison.	/ 4	
5: Root locus diagram.	/ 2	
6: Disturbance rejection.	/ 4	
Code Bonuses	/ 0	
Total	**/ 20**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 2: Water Tank System Response

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Abstract	/ 4	
Introduction	/ 4	
Theory		
1: Model equations.	/ 4	
2: τ from ramp asymtote.	/ 4	
3: One-tank on/off mass balance.	/ 4	
4: Laplace domain for second tank.	/ 4	
5: Ramp and step responses.	/ 4	
6: $\tau_1 + \tau_2$ from ramp asymtote	/ 4	
7: Two-tank on/off control mass balance.	/ 4	
Results and Discussion		
Evaluation of Time Constants		
1: Fractional filling and emptying.	/ 5	
2: Semi-log Tank 1 plot.	/ 5	
3: Tank 2 theoretical response.	/ 5	
Ramp Input		
1: Ramp plots.	/ 5	
2: Time constant estimates.	/ 5	
Responses		
1: On/off theory vs. experimental.	/ 5	
2: Linear vs. square root discharge.	/ 5	
Conclusion	/ 4	
Appendices	/ 5	
Figures/Tables	/ 5	
General	/ 5	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 3: Data Acquisition

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Abstract	/ 4	
Introduction	/ 4	
Theory		
1: Thermally-induced EMF and noise.	/ 8	
2: Thermocouple heat transfer model.	/ 8	
3: Water heat transfer model.	/ 8	
Results and Discussion		
Part A		
1: Calibration.	/ 4	
Part B		
1: Time constant estimates.	/ 4	
2: Theor. vs. exp. step response.	/ 5	
Part C		
1: Data acquisition plots.	/ 4	
2: Validity of assumptions.	/ 4	
3: Graphical estimates of τ.	/ 6	
Part D		
1: Log-log plot and filter order.	/ 4	
2: Filter performance.	/ 4	
3: Filter noise suppression.	/ 4	
Conclusion	/ 4	
Appendices	/ 5	
Figures/Tables	/ 5	
General	/ 5	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 4: Process Identification

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Abstract	/ 3	
Introduction	/ 3	
Theory		
1: Mass balances.	/ 6	
2: Pulse input solutions.	/ 6	
3: Process ID.	/ 6	
4: Parameters from Bode plots.	/ 6	
5: Parameters from step tests.	/ 6	
Results and Discussion		
1: Bode plots.	/ 6	
2: Identification results.	/ 6	
3: Pulse test plots.	/ 6	
4: Step test plots	/ 6	
5: Effects of pulse duration.	/ 6	
6: Recommended ID method.	/ 6	
Conclusion	/ 3	
Appendices	/ 5	
Figures/Tables	/ 5	
General	/ 5	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 5: Tuning a Level Controller

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Abstract	/ 3	
Introduction	/ 3	
Theory		
1: Nonlinear height ODE.	/ 3	
2: Linearized ODE.	/ 4	
3: Laplace domain.	/ 4	
4: Valve coefficient.	/ 4	
5: Closed-loop transfer functions.	/ 5	
6: P offset.	/ 5	
7: PI offset.	/ 5	
8: Effects of controller parameters.	/ 5	
Results and Discussion		
1: Figures/Tables	/ 6	
2: Voltage calibrations.	/ 6	
3: Draining standpipe plot.	/ 6	
4: Control setpoint changes.	/ 6	
5: Real vs. theoretical control.	/ 6	
6: Linearity, sample time, and deriv. cont.	/ 6	
Conclusion	/ 3	
Appendices	/ 5	
General	/ 5	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 6: Feedback, Feedforward, and Cascade Control

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Abstract	/ 3	
Introduction	/ 3	
Theory		
1: Table 3.6 expressions.	/ 5	
2: Goals of Ziegler-Nichols.	/ 5	
3: Perfect feedforward cont.	/ 5	
4: Limitations of feedforward cont.	/ 5	
5: Feedforward/feedback cont.	/ 5	
6: Cascade cont.	/ 5	
7: Closed-loop transfer func.	/ 5	
Results and Discussion		
1: Controller plots.	/ 3	
2: Plot labels.	/ 3	
3: Qualitative cont. parameters.	/ 5	
4: Better than ZN tuning.	/ 5	
5: Tuning for disturbances.	/ 5	
6: Feedback vs. feedforward.	/ 5	
7: Feedback vs. cascade.	/ 5	
Conclusion	/ 3	
Appendices	/ 5	
Figures/Tables	/ 5	
General	/ 5	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 8: Control of a Stirred Heating Tank

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Introduction	/ 3	
Theory		
1: Multivariable linearization.	/ 6	
2: State space Laplace transform.	/ 6	
3: Closed-loop transfer function.	/ 8	
4: Decoupler design.	/ 6	
5: Simulated setpoint changes.	/ 8	
Results and Discussion		
1: Flow calibration curves.	/ 5	
2: Steady-state relationships.	/ 5	
3: Nonlinear and linear model.	/ 5	
4: Step tests and models.	/ 5	
5: ZN tuning and decoupler.	/ 5	
6: Setpoint step.	/ 5	
7: Decoupled setpoint step.	/ 5	
Conclusion	/ 3	
Figures/Tables	/ 5	
General	/ 10	
Bonuses	/ 0	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 9: Control of a Distillation Column

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Introduction	/ 3	
Theory		
1: Multivariable linearization.	/ 6	
2: State space Laplace transform.	/ 6	
3: Closed-loop transfer function.	/ 8	
4: Decoupler design.	/ 6	
5: Simulated setpoint changes.	/ 8	
Results and Discussion		
1: SISO transfer functions.	/ 5	
2: Step test plots.	/ 5	
3: RGA and ZN tuning.	/ 5	
4: Further tuning.	/ 5	
5: Setpoint step tests.	/ 5	
6: Large sampling time.	/ 5	
7: Steady-state decoupler.	/ 5	
Conclusion	/ 3	
Figures/Tables	/ 5	
General	/ 10	
Bonuses	/ 0	
Total	**/ 90**	

General Comments:

CBE470: Process Dynamics and Control
Experiment 10: Control of a Copolymerization Reactor

TA:

Group: Week: Students: Phys. / Sim.

Report Section	Score	Comments
Introduction	/ 3	
Theory		
1: Multivariable linearization.	/ 6	
2: State space Laplace transform.	/ 6	
3: Closed-loop transfer function.	/ 8	
4: Decoupler design.	/ 6	
5: Simulated setpoint changes.	/ 8	
Results and Discussion		
1: Approximate K and τ.	/ 5	
2: RGA, pairing, and ZN tuning.	/ 5	
3: Manual control.	/ 5	
4: Feed ratio disturbance.	/ 5	
5: Inhibitor disturbance.	/ 5	
6: Re-tuned feed ratio disturbance.	/ 5	
7: Steady-state decoupler.	/ 5	
Conclusion	/ 3	
Figures/Tables	/ 5	
General	/ 10	
Bonuses	/ 0	
Total	**/ 90**	

General Comments: