

Names: 1)_____ Grade:___/100 2)_____ Grade:___/100 3)_____ Grade:___/100



MECH 343: MODELING DYNAMIC SYSTEMS

Grading Rubric for Laboratory #1: Introduction to Hardware

Grade : _____ / 80

___ Meets Honest Effort Attempt

___ Turned in on time AND to the correct location (B10 box)

Objective: ___/5

(5) Identifies overall goal of the experiment

Procedure: ___/10

(5) Identifies equipment used

(5) Explains how data was collected (step-by-step)

Results and Discussion: ___/60

Part I: ___/15

(15) Explains physics behind change in brightness of LEDs (series vs. parallel)

i. Increase in voltage to each resistor when in parallel, or

ii. Increase in current, or

iii. Increase in power

Part II: ___/15

(5) Gives resistance for 10-ohm resistor (Fluke & Labview)

(5) Gives resistance for 100-ohm resistor (Fluke & Labview)

(5) Explanation for difference

iv. Manufacturing imprecision is the reason for the tolerance

v. Minus 2 if no explanation or guess is given

Part III: ___/15

(15) Calculates theoretical voltage drop across 10-ohm and 100-ohm resistors when in series with the 4V power supply

vi. Uses the 4V from the power supply in their calculation

vii. Does NOT use *measured* current from multimeter

viii. $V_{100\text{-ohm}} = 3.636 \text{ V}$

ix. $V_{10\text{-ohm}} = 4\text{V} \cdot 10 / (100\text{-ohm} + 10\text{-ohm}) = 0.3636 \text{ V}$

Part IV: ___/15

(10) Calculates theoretical current through circuit

x. $V = IR \dots I = 4\text{V} / 110\text{-ohm} = 0.03636\text{A} = 36.36 \text{ mA}$

(5) Compares to multimeter and labview values

Conclusion: ___/5

(5) States a correct, concise conclusion derived from results and discussion

Quality of Writing

___ (-1) for each blatant error in writing quality, professionalism, or appearance

Pre Lab Assignment: 1_____/20

2_____/20

3_____/20

(10) Correct Resistor Values

(5) Correct Capacitor Values

(5) Correct Circuits

Names: 1) _____ Grade: ____/100 2) _____ Grade: ____/100 3) _____ Grade: ____/100



MECH 343: MODELING DYNAMIC SYSTEMS

Grading Rubric for Laboratory #2: Parameter Identification: Inertia, Torque Constant, and Sensor Calibration

Grade : ____/ 80

____ Meets Honest Effort Attempt
____ Turned in On Time

Objective: ____/5

(5) Identifies overall goal of the experiment

Procedure: ____/5

(2) Identifies equipment used
(3) Explains how data was collected (step-by-step)

Results: ____/ 35

Part I: ____/12

(3) Correctly calculates ω in determining J_{cm}
(3) Provides correct value of J_{cm}
(3) Provides correct value of J_p
(3) Provides table showing time to reach 20 oscillations

Part II: ____/12

(6) Provides table showing angles and respective voltages
(6) Provides *well-labeled* plot of Paddle position vs. signal voltage with linear trend line

Part III: ____/11

(6) Produces plot of T_m vs i_{arm}
(5) Determines K_t from plot

Discussion: ____/ 30

Part I: ____/5

(5) Discusses necessity of small initial displacement of hanging mass

Part II: ____/12

(7) Explains how the perpendicular component of the applied magnetic field is linear with the paddle angular position

(5) Includes figure of magnet and its flux lines, the sensor, and angle of displacement

(?) Bonus points for additional relevant discussion

Part III: ____/13

(5) Provides equation expressing torque as a function of current
(5) Discusses how torque constant was characterized
(3) Compares K_t to that provided in the spec sheet

Conclusion: ____/5

(5) States a correct conclusion derived from Results and Discussion

Quality of Writing

____ (-1) for each blatant error in writing quality, professionalism, or appearance

Pre Lab Assignment: 1 ____/20

2 ____/20

3 ____/20

Part I: ____/8

(3) Show K_{BP}

(3) Derive J_{cm}

(2) Derive J_p

Part II: ____/5

(5) Produce SAA Table

Part III: ____/7

(3) Draws correct FBD with parameters labeled

(2) Determines N

(2) Derives the equation for T_m

Names: 1) _____ Grade: ____/100 2) _____ Grade: ____/100 3) _____ Grade: ____/100



MECH 343: MODELING DYNAMIC SYSTEMS

Grading Rubric for Laboratory #3: First and Second Order Electrical Systems

Grade : ____ / 85

____ Meets Honest Effort Attempt

____ Turned in on time AND to the correct location (box outside B10)

Objective: ____/5

(5) Identifies overall goal of the experiment

Procedure: ____/5

(2) Identifies equipment used

(3) Explains how data was collected (step-by-step)

Results: ____/30

Behavior of RC circuit

(6) Observes correct voltage potential across C and across R for constant input

(9) Provides 3 plots of first order responses (for varying frequencies). The inputs and outputs must be clearly distinguishable.

Behavior of RLC circuit

(6) Provides value of resistance at observed critical damping

(9) Provides 3 plots of second order responses (under damped, critically damped, over damped). The inputs and outputs must be clearly distinguishable.

Discussion

Behavior of RC circuit: ____/20

(2) Correctly presents analogous first order system

(3) Adequately explains results of RC circuit with constant input

(1) Recognizes input to circuit (i.e. what is the input and where does it come from?)

(1) Recognizes output from circuit (i.e. what is the output)

(4) Discusses relationships between input frequency and output; and input amplitude and output

(5) Provides theoretical differential equation and solution for step input

(4) Discusses relationship between R and τ ; and τ and rise/fall time

Behavior of RLC circuit: ____/20

(2) Correctly presents analogous second order system

(6) Provides theoretical differential equation and solution for step input for underdamped motion

(6) Provides theoretical differential equation and solution for step input for crit. damped motion

(4) Discusses relationship between damping ratio and type of 2nd order response; and between R and the damping ratio

(2) Adequately explains unexpected findings

Conclusion: ____/5

(5) States a correct, concise conclusion derived from results and discussion

Quality of Writing

____ (-1) for each blatant error in writing quality, professionalism, or appearance

Pre Lab Assignment: 1 ____/15

2 ____/15

3 ____/15

(2) Correctly answers questions in 1

(2) Correctly answers questions in 2

(3) Correctly identifies frequency and amplitude values

(3) Correctly calculates the critical resistance value

(5) Provides well-labeled plot and the MATLAB script

Names: 1) _____ Grade: ____/100 2) _____ Grade: ____/100 3) _____ Grade: ____/100



MECH 343: MODELING DYNAMIC SYSTEMS

Grading Rubric for Laboratory #4: First and Second Order Electrical Systems

Grade : _____ / 85

____ Meets Honest Effort Attempt

____ Turned in on time AND to the correct location (box outside B10)

Objective: ____/5

(5) Identifies overall goal of the experiment

Procedure: ____/5

(2) Identifies equipment used

(3) Explains how data was collected (step-by-step)

Results: ____/30

Behavior of RC circuit

(6) Observes correct voltage potential across C and across R for constant input

(9) Provides 3 plots of first order responses (for varying frequencies). The inputs and outputs must be clearly distinguishable.

Behavior of RLC circuit

(6) Provides value of resistance at observed critical damping

(9) Provides 3 plots of second order responses (under damped, critically damped, over damped). The inputs and outputs must be clearly distinguishable.

Pre Lab Assignment: 1 ____/15

2 ____/15

3 ____/15

(2) Correctly answers questions in 1

(2) Correctly answers questions in 2

(3) Correctly identifies frequency and amplitude values

(3) Correctly calculates the critical resistance value

(5) Provides well-labeled plot and the MATLAB script

Discussion

Behavior of RC circuit: ____/20

(2) Correctly presents analogous first order system

(3) Adequately explains results of RC circuit with constant input

(1) Recognizes input to circuit (i.e. what is the input and where does it come from?)

(1) Recognizes output from circuit (i.e. what is the output)

(4) Discusses relationships between input frequency and output; and input amplitude and output

(5) Provides theoretical differential equation and solution for step input

(4) Discusses relationship between R and τ ; and τ and rise/fall time

Behavior of RLC circuit: ____/20

(2) Correctly presents analogous second order system

(6) Provides theoretical differential equation and solution for step input for underdamped motion

(6) Provides theoretical differential equation and solution for step input for crit. damped motion

(4) Discusses relationship between damping ratio and type of 2nd order response; and between R and the damping ratio

(2) Adequately explains unexpected findings

Conclusion: ____/5

(5) States a correct, concise conclusion derived from results and discussion

Quality of Writing

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MECH 343: MODELING DYNAMIC SYSTEMS

Grading Rubric for Laboratory #5: Time Domain System Identification

Grade : ____ / 80

____ Meets Honest Effort Attempt and Turned in on time AND to the correct location (box outside B10)

Objective: ____/5

- (5) Identifies overall goal of the experiment

Procedure: ____/5

- (2) Identifies equipment used
- (3) Explains how data was collected (step-by-step)

Results: ____/30

Part I: ____/15

- (2) Produces plot of ω vs t
- (3) Determines τ from plot
- (2) Correctly calculates J_{spin} for determining B_{spin}
- (3) Determines value for B_{spin}
- (3) Determines value for B_m
- (2) Produces theoretical plot of ω vs t

Part II: ____/15

- (3) Produce a plot of θ vs t
- (4) Calculate ζ and ω_n from plot using log dec.
- (4) Determine m_{eq} , b_{virt} , k_{virt}
- (4) Determine b_{mech}

Discussion: ____/35

Part I: ____/20

- (4) Provides first order EOM
- (4) Provides time response equation
- (4) Discusses utility of time constant
- (4) Explains differences between theoretical and experimental plots
- (4) Discusses similarities and dissimilarities of dynamic systems and time responses

Part II: ____/15

- (5) Discuss why the haptic paddle virtual system possesses steady state error
- (10) Compare b_{mech} to b_m . Include discussion of b_{elec} , sources of error

Conclusion: ____/5

- (5) States a correct conclusion derived from Results and Discussion

Quality of Writing

____ (-1) for each blatant error in writing quality, professionalism, or appearance

Pre Lab Assignment: 1 ____/20

2 ____/20

3 ____/20

Part I: ____/10

- (3) Draws correct FBD
- (2) Generates EOM
- (2) Derives expression for $\alpha(t)$
- (1) Derives τ as a function of J_{spin} and B_{spin}
- (1) Determines the value of the ratio $\alpha(\tau)/\alpha(0)$
- (1) Derive the equation for V_{emf} in terms of V_{arm}

Part II: ____/10

- (5) Derive f_{eq} , m_{eq} , b_{eq} , and k_{eq} . Show FBD.
- (3) Derive b_{virt} , k_{virt}
- (2) Derive b_{elec}

Extra Credit: _____

- (+2) Explains sudden drop in V_{arm}
- (+2) Details how to experimentally characterize voltage constant
- (+2) Explain fluctuation during spin up
- (+2) Explain how to improve Part II experiment

Names: 1)_____ Grade:___/100 2)_____ Grade:___/100 3)_____ Grade:___/100



MECH 343: MODELING DYNAMIC SYSTEMS

Grading Rubric for Laboratory #6: Haptic Paddle-Virtual Systems and Teleoperation

Grade : _____ / 100

___ Meets "Honest Effort" criteria and turned in on time AND to the correct location (box outside B10)

Objective: ___/15

(15) Identifies overall goal of the experiment

Procedure: ___/10

(5) Identifies equipment used

(5) Explains step-by-step what happened in the lab

Discussion: ___/65

(10) Satisfactory discussion of haptic systems, for example Phantom haptic system, and teleoperation.

(15) Satisfactory discussion of haptic paddle system, specifically, the effect of gains on each environ.

(15) Discussed observed discrepancy between theoretical and experimental results (what did our model neglect that affected performance? Limits of stability and haptic paddle force output could be an interesting discussion point.)

(15) Discussed why each lab was important, in its own, special way

(10) Provided some element of feedback for next year's MECH 343

Conclusion: ___/10

(10) States a conclusion

Quality of Writing

___ (-1) for each blatant error in writing quality, professionalism, or appearance

Extra Credit: _____ (+TBD) Discussion or feedback exceeds expectations
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