ME 360: FUNDAMENTALS OF SIGNAL PROCESSING, INSTRUMENTATION, AND CONTROL

Experiment No. 4
Modeling and Identification of an Electric Motor using Step Response and Frequency Response Methods
Data Sheet

STEADY-STATE GAIN (10 PTS)

V_{DAC} [V]	V_{DMM} [V]	$K = V_{DMM} / V_{DAC}$ [V/V]
3		
4		
5		
6		

Observations:

STEP RESPONSE (20 PTS)

	Data	
	$V_{in}(t \geq 0)$	4 V
	$V_{out}(\infty)$	
	$K = V_{out}(\infty) / V_{in}(t \geq 0)$	
Time at 63.2 % of Maximum Change	$\tau_{63.2}$	
Iterative Fit of Observed Response Data	K_{fit}	
	τ_{fit}	

Observations:

Discuss possible inaccuracies using the 63.2% rule to find K and τ. Using the iterative fit method to find K and τ. (5 pts)

FREQUENCY RESPONSE (30 PTS)

Method		**Data**				
Manual Sine Sweep		f [Hz]	$V_{p\text{-}p,\ out}$ [V]	G(f) [V/V]	t_{delay} [s]	ϕ(f) [°]
V_{offset} [V]		0.2				
$V_{p\text{-}p,\ in}$ [V]		0.4				
Manual Sweep Calculations		0.8				
K [V/V]		1.6				
Break Freq. $f_{b\ -3\ dB}$ [Hz]		3.2				
Break Freq. $f_{b,\ 45°}$ [Hz]		6.4				
$\tau_{-3\ dB}$ [s]		8.0				
$\tau_{45°}$ [s]		10.0				

Observations:

FREQUENCY RESPONSE OF BEAM-MASS SYSTEM (5 PTS)

Results for Sine-swept Method for Beam System			
Parameter	measured	calculated	units
Primary Natural Frequency f_{nb}		21.5	Hz
Gain at Primary Natural Frequency G(f_{nb})			dB
Secondary Natural Frequency f_{nc}			Hz
Gain at Secondary Natural Frequency G(f_{nc})			dB

What is the source of each of the primary and secondary peaks in frequency response of the beam-mass system?