MAE 3724 Systems Analysis
Fall 2019

Laboratory Experiment 9
Frequency Response of a Speaker

Final Report for Lab 9 (Each individual must submit a Final Report)

SHOW ALL YOUR WORK ON THIS AND THE FOLLOWING PAGE. Scan these pages and the requested plots and upload them into the Brightspace Dropbox for Lab 9.

1) *[2 pts]* What was the overall sensitivity for the DCDT (in V/mm)? *(Show how you calculated this.)*

Sensitivity = $31 \frac{mV}{mm} = 31E\text{-}3 \frac{V}{mm}$

2) *[3 pts]* Process your measured data using the table below. The sixth column plotted against the second column will be the Bode plot asked for in part 3.

Measured Data					
Frequency f (Hz)	Frequency ω (rad/s)	Magnitude X (V)	Magnitude X (mm)	Magnitude M (mm/V)	m (dB)
3					
5					
7					
10					
15					
20					
30					
50					
70					
100					
200					

(Note: Column 4 is simply a conversion from Volts to mm using the sensitivity calculated in Part 1)

3) *[5 pts]* Make a bode plot overlaying the measured (experimental) data and the model data from the Pre Lab 9 (Bode plot generated from "`SpeakerBode`" script on D2L under "*MATLAB Resources*"). The frequency (rad/s) should be on a **"log scale"**. The vertical axis should be the magnitude (originally mm) converted to m (in dB).

Attach your plot to the Final Report.

Directions for plotting using a "log scale" in EXCEL 2016.

Plot a scatter plot of the data as you normally would. Right click on the horizontal axis values and select "Format Axis." A side bar should appear showing the "Axis Options" of the axis you clicked. Under "Axis Options" select the "Logarithmic scale" box and double check that it is "Base 10." Close the side bar.

4) *[5 pts]* Compare your measured response to the model response. Give an explanation for ***any*** differences.

The curves appear to follow the same general shape, just have an offset that could be due to ~~the~~ error in measuring physical parameters of the speaker

5) *[5 pts]* Does the plot of the magnitude vs. frequency of the measured data have a final slope of -60 dB per decade? If so, why? If not, why not?

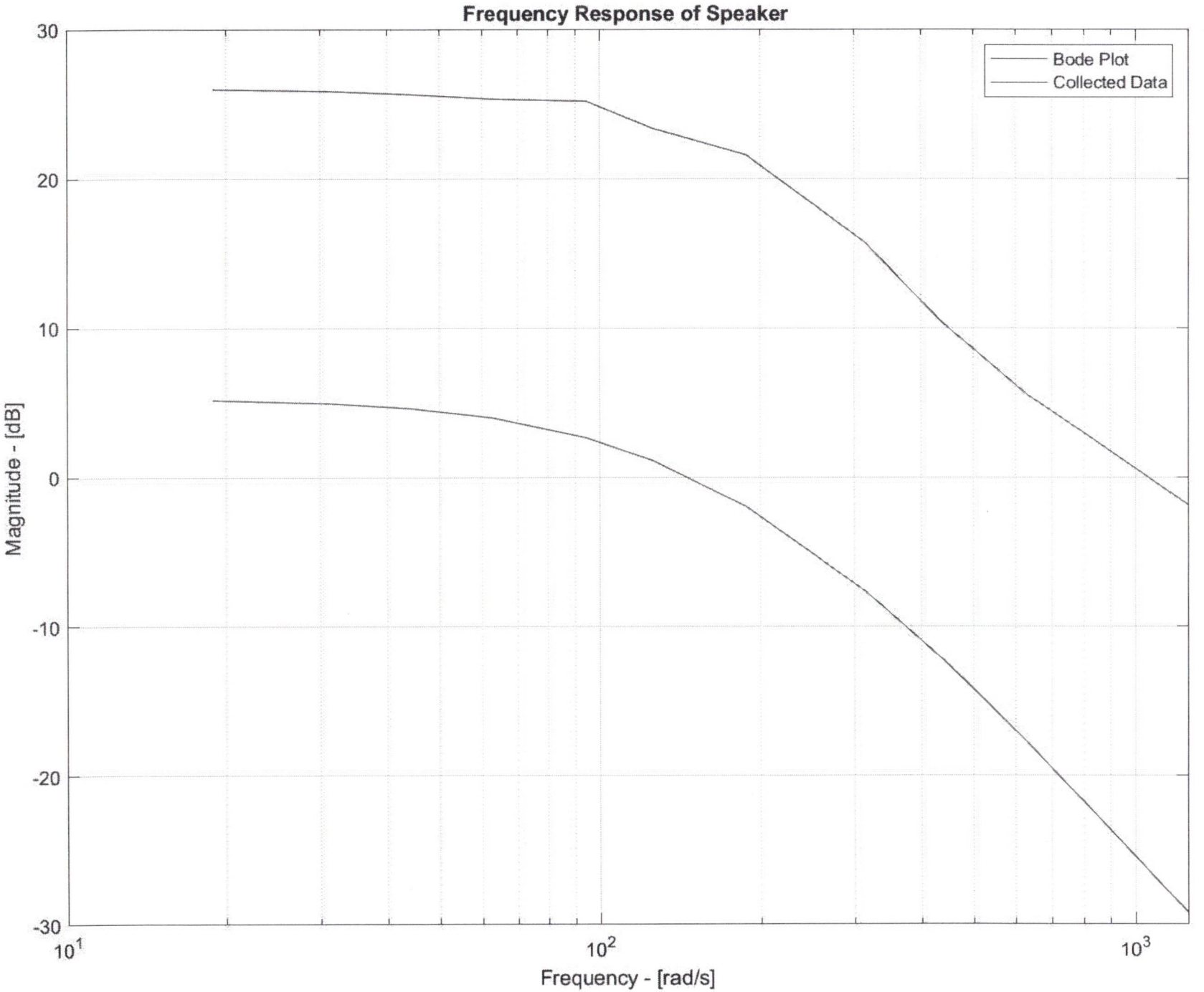
No, this could be because the inductance of the speakers is close to 0.

FEEDBACK (Answers do not affect the grade)

Answers to the following questions will not affect the grade, but may help us improve the experiment for the future.

a) What did you learn from this experiment?

b) What are your suggestions for making the experiment more beneficial?


Frequency Response of Speaker
Bode Plot
Collected Data
30
20
10
0
-10
-20
-30
Magnitude - [dB]
10^1
10^2
10^3
Frequency - [rad/s]

Frequency f [Hz]	Frequiency w [rad/s]	Magnitude X (V)	Magnitude X (mm)	Magnitude M (mm/V)	m (dB)
3	18.84955592	1.233	39.77419355	19.88709677	25.97142774
5	31.41592654	1.215	39.19354839	19.59677419	25.84369177
7	43.98229715	1.187	38.29032258	19.14516129	25.64118059
10	62.83185307	1.145	36.93548387	18.46774194	25.32827594
15	94.24777961	1.127	36.35483871	18.17741935	25.19064453
20	125.6637061	0.914	29.48387097	14.74193548	23.37109012
30	188.4955592	0.743	23.96774194	11.98387097	21.57194249
50	314.1592654	0.379	12.22580645	6.112903226	15.72495041
70	439.8229715	0.203	6.548387097	3.274193548	10.30208697
100	628.3185307	0.118	3.806451613	1.903225806	5.589806356
200	1256.637061	0.05	1.612903226	0.806451613	-1.8684337