

Assignment

Homework HW1

Master program in Music and Acoustic Engineering

Musical Acoustics

course code: 051483

Academic year 2023/2024



POLITECNICO
MILANO 1863

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Problem

Characterization of a resonator

It is given a resonator with a mass $m = 0.1$ kg and a stiffness $K = 2.53 \cdot 10^4$ N/m.

- a) Compute the resonance frequency of such a resonator.

Through experiments, it is observed that the motion of this system decays by 5 dB in a time $t_{-5} = 0,576$ s.

- b) Based on the above information, compute the decay time τ of the system.
- c) Compute the quality factor Q .
- d) Compute the resistance R associated to the system.
- e) Compute the -3dB bandwidth of the resonance.
- f) Plot the admittance of the system.

The system is now subject to the external force $F = 0.1 \sin(2\pi f_I t)$ N, where $f_I = [60, 80, 100, 120, 140, 160]$ Hz. The external force starts at time $t_0 = 0$, while before $F = 0$ and the resonator is at rest.

- g) Compute the time responses of the system for the different values of the input frequency and plot them.

Provide the solution by Oct. 2, 2023, using the WeBeep assignment tool.

- The report must fit in 6 pages of the Latex template available at <https://www.overleaf.com/read/rnkchgybrrsm>;
- Answer concisely;
- Describe – concisely - the procedure used to obtain the results: if an error is present, I cannot identify the reason – numerical or conceptual - if the procedure is not described: in grading I will be forced to use the worst-case option.
- All students who participated to the same group must upload the report;
- In the PDF file and in the filename, specify the name, surname and ID of all the students participating to the HW, if more than one student worked on it.