

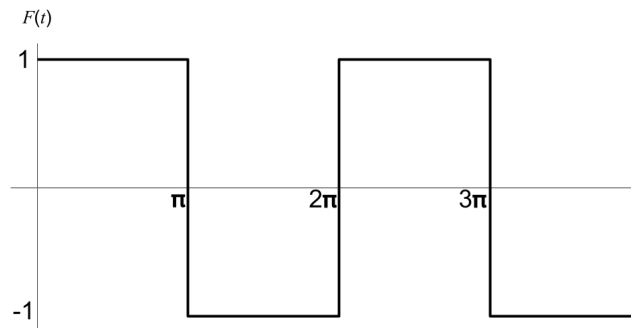
## Project 6 [6 FP “Fluency Points”]

### *Steady-State Vibration Response to a Periodic Excitation Using Fourier Series*

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#### Description:

A 1-DOF (linear) mass-spring-damper system is subject to the following periodic excitation:



Visualize the resulting vibration of the mass. Specifically:

- Use a Fourier series to approximate the excitation.
- Solve for the steady-state (particular) solution.
- Plot, with high accuracy, the steady-state solution against time.
- You may use Google Sheet or Matlab to generate the plot
- All parameters such as  $m$ ,  $k$ ,  $c$ ,  $\Delta t$  etc. may be arbitrarily assumed, but must be easily modifiable by the user of your Sheet or code.
- Draw conclusions regarding the extent of the infinite sum of the Fourier series, justify the accuracy of your plot, and comment on the overall technical rigor of your analysis.
- Reflect on your learning and journey of working on this project.

#### Deliverables:

Present your work in a typed technical memorandum (tech memo; PDF only). The plot must be included in the tech memo.

Additionally, in a separate submission text box, copy and paste your Google Sheet URL if you use Google Sheet for plotting, or your source code if you use Matlab.

#### Rules and Formatting:

- This is an individual project, to be done by you and you alone
- The tech memo must be typed, except for sketches and equations where handwritten work may be included
- Content and file requirements
  - Your tech memo must contain the entirety of your work for this project, including vibration modeling, mathematical formulation and solution, a plot, a conclusion, and

- reflection
- Your entire tech memo must be in portrait orientation and has a vertical page flow
- [If using Google Sheet] Your Sheet must not be edited after you have submitted it to Gradescope (your Google Sheet will show the last edit date to any viewer, so be sure not to modify it after submitting!)
- Google Sheet or Matlab functionality requirements
  - It must include instructions for the user
  - It must allow the user to quickly change values of the parameters described above
  - It must generate a plot that instantly updates whenever an input value changes
  - [If using Google Sheet] It must have only one sheet (or “tab”); all data and plot must be shown in the same tab

Submission:

Submit your tech memo PDF *and either* your Google Sheet URL *or* Matlab source code on Gradescope only. Submissions by email or other means will be disregarded.

Due on Nov 8, 2021 (Monday), at 11:59 pm CST.

Late submissions will be subject to the “half-life” reduction policy according to the syllabus.

Grading Rubric:

	Fluency			Scaling	Max Possible
	2	1	0		
<b>Technical Rigor</b>	<p><u>Tech Memo:</u> Assumptions are reasonable and not oversimplified; physics, math and data are accurate and convincing</p> <p><u>Google Sheet or Code:</u> Data are generated using the correct equations; plot is accurate</p>	Some obvious details missing	Farfetched, or missing most details	1	2
<b>Professionalism</b>	<p><u>Tech Memo:</u> Presentation of work is logical, legible, and easy to follow; format is well-structured; free from grammatical or typographical errors; a joy to read</p> <p><u>Google Sheet or Code:</u> Instructions and annotations for the user are clear, changing parameters is easy, plot is well formatted</p>	Some obvious issues with coherence and/or format	Full of errors; hard to follow; illegible	1	2
<b>Rationale, Justification, Reflection</b>	Conclusions are insightful, thoughtful and transparent; goes beyond “pointing out the obvious”; reflection is thoughtful and authentic, and suggests future (self-)improvements	Insubstantial or vague	Missing altogether	1	2
<b>Max Possible:</b>					<b>6</b>