AE 326: Assignment 1

The following assignment is designed to give you a hands-on feel for creating and working with simple (table top) experiments and use it for interesting purposes. Such home projects are meant to be fun and provide an appreciation of the subject, especially the differences between modeling and real world working of simple practical systems.

Motivation

In subsequent lectures, we shall study approximate modeling of continuous systems (such as beams, strings, rods, and shafts) in which we reduce an infinite degree of freedom (DOF) system to 1-DOF and 2-DOF systems. This is the quantitative counterpart of the process of abstraction we had discussed in the early part of the course. It is useful to have at your disposal a simple table top set up that can be used to perform a quick experiment. This is the aim of the current assignment.

Aim

Create an oscillatory 1-DOF system that you can use to perform quick experiments for models that may come up later in the course. The oscillatory system should be (a) portable, (b) tunable, (c) expandable, and (d) homemade.

Portable implies that the set up should be physically small, i.e., in terms of geometric dimensions and weight, so that it is easy for you to transport. There are numerous ways to achieve this. I will leave it to you to come up with your own design.

Tunable implies that you should be able to modify the characteristics of the system to mimic the oscillatory characteristics of various 1-DOF systems that we shall meet in the course. Typically, this includes the mass, stiffness, and damping (if you plan to include this). However, the details are likely to depend on your specific design.

Expandable implies that you should be able to modify the 1-DOF to a 2-DOF system if required. This requires a bit of thought.

Homemade implies that the set-up is created using items that are readily available in your vicinity. It is either free of cost or extremely inexpensive, and easy to repair or fix. The entire purpose is to experience engineering in a nascent form where ingenuity, resourcefulness, and intuition, along with some amount of judicious quantitative analyses, were used to solve problems. Therefore, using precision manufactured components or ready-to-assemble kits defeats the purpose of the assignment.

A hint on challenges:

1. Creating a setup that is truly 1-DOF is harder than you may think. If required, you'll have to go through a few iterations of the design.
2. The expandable nature of the setup is not as difficult as it might seem at first glance, but some amount of foresight and planning are absolutely needed.
3. Some amount of self-study may be needed depending on how your design shapes up. You'll need to learn whatever is required in order to create the setup irrespective of whether it was covered in this or any other course.

I am more than happy to discuss if you wish to bounce ideas or seek clarification on anything pertaining to this.

Assessment

You'll need to bring your table-top setup to the classroom and demonstrate how the 1-DOF system works. You will have to demonstrate the qualities listed above by showing how adjustments or extensions can be made.

Points	What it means	Remarks and details
0	Did not show up	Not much to add…
4	Below expectations	• Does not possess one or more qualities required from the setup. • The set up clearly reflects insufficient thought or effort. • In general, a subpar effort.
8	Meets expectations	• The set up clearly reflects careful planning and effort. • Has all the qualities demanded from the setup. • Able to perform quick experiments to demonstrate the setup. • In general, has everything. Not much to complain about.
10	Outstanding	• Has everything in the 'Meets expectations' category. • Clearly a step up in terms of inventiveness, novelty, or innovative idea. • Should be clearly and agreeably over and above the norm. • In general, makes the instructor go 'Wow!'.