Design Reflection

As an engineering student, design is integral to my work and study, and with that comes the need to plan, execute, and even to make decisions at the moment. In this document, I will outline the different design aspects involved, and reflect on how they went in hindsight.

Design Decisions

Failing to plan is planning to fail. Before approaching each lab, it is necessary to plan for good use of time throughout the 6 lab sessions. During the first lab session, I will read through the lab writeup, if one is available, and study the theory and procedures, so I understand how the experiment is conducted. I will then talk to the TA to clarify technical details which I do not understand, and also discuss with the professor to understand the goals of the experiment. Based on the feedback, I would then roughly plan out my sessions. I usually spend the remainder of the first session trying to run trials of the experiment, since it is often difficult to get the first set-up running.
For the second and third sessions, I would focus on understanding the theory and doing further research if needed. In many cases, it is helpful to perform the experiment during the process, which helps to understand the theory. For example, in the C3D experiment, my understanding of the theory states that the distance between the voltmeter probes do not matter, as long as width is constant. I was able to immediately test it to check my understanding.
For the final sessions, I would focus on taking data and writing code. There are usually different aspects to the experiment, which are distributed among the sessions. For example, in FAR, I noticed how symmetry changes with frequency, so I devoted a session to study this effect in addition to the main experiment.

What worked, what didn't

This planning approach worked well for C3D and FAR, where I was able to conduct experiments methodically. Moreover, the plan was flexible enough that I was able to take time out to study interesting phenomena on the spot. For C3D, this was the effects of a small 2D conductor, and for FAR, it was symmetry as mentioned. However, this approach was not as good for FTIR, which did not have a writeup. Although I was able to catch up on theory and learn how to operate the equipment, the lack of a writeup meant it was difficult to find direction in the experiment. I began to use ATR to investigate material properties, which is not exactly related to the principles of the technology. In hindsight, I could have looked into the advantages and limitations of FTIR through strategic use of samples and materials. This could include how different bonds may have similar peaks, and how peak magnitude is not a strong indicator of abundance.
In terms of understanding theory, there is room for improvement. My approach worked well for C3D and FTIR, but I spent too much time trying to understand the mathematical details of the differential equations for ω_0. In the future, I

would start by skimming through the writeup and decide on the important parts of theory to focus on. If I am unable to get a basic grasp of the theory behind the entire experiment in the first session, I will consider either spending time outside of the lab, so I can focus on the experiment during lab hours, or re-evaluate what is necessary to know before performing the experiment. I am satisfied with taking data and writing code. This usually happens in the latter half of lab sessions, so it is likely that I am more familiar with the theory and equipment, with a clear understanding of my goals, which is conducive for effective work.