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Final Project

Animating Recorded Impedance Values

Idea Approved by: Quinn Lanik

I (Aidan) work in a Proton-Exchange Membrane (PEM) Laboratory where we synthesize polymers to be used as electrolytes within PEM fuel-cells. To study the effectiveness of certain membranes, we need to investigate their proton conductivity, or ability to pass positive hydrogen ions through the length of the polymer membrane between the electrodes—essentially providing us with an idea on how well they can help fuel cells generate electricity. However, the conductivity of a substance is not a directly measurable quantity. Thus, we record the impedance of the specific membrane then relate that to the resistance and therein the conductivity. There are a handful of graduate level equations involved, so I will not get into the details I will just describe the situation I, the lab assistant, was put in to complete this objective.

Old software required me to take hundreds of data points, and manually input them into Excel just to plot the graph. Six Ions, three temperatures each, 100 data points per ion per temperature, and I needed to take three readings per ion per temperature. It took weeks. I always thought a MATLAB program could achieve the same task in minutes. So, with this lab, that is exactly what we did.

It takes in data in the same way the data would be copy and pasted directly from the source to excel. To reduce excess confusion and allow graders to understand the plots, the program would need minor adjustments to fit the real-world situation exactly. However, the buttons and slider allow me or my graduate student supervisor to compare the performance of multiple different forms of this polymer with the click of a button. The program we made requires .csv files in a particular format. Each file should contain all ions and pertain to a single temperature. The basic idea is we what to see the difference in the shape of each graph between ions, the change in temperature is to ensure that the trends we observe maintain despite the change in temperature. Therefore, the scroll bar which changes between ions is animated, and the changing of the temperature plots is a manual button. The animation really gives an easy way to observe these differences whereas before, I needed to click between each and every excel file and plot. Our code is solving two separate automation issues for me, the inputting of data, and the ability to easily observe trends in our data.

Graphical user interfaces have been a very enjoyable topic to learn during this class, and they could be a very helpful in future classes or even in the workplace. GUI’s can be helpful in almost any class that involves visualizing data sets. Setting up a graphing GUI, like the one in our project, is probably the simplest way to view very large data sets from a csv file. GUIs also make it very easy to switch between data sets, which could be very useful for comparing separate sets of data. All the future uses of GUI could also be applied to the workplace, viewing, and comparing data sets is made very convenient with this MATLAB function.

Overall, this class was probably one of my (Nate) favorites for the semester. The online approach of everything this year has been quite difficult, but it seemed to work well for this class. I personally enjoyed learning MATLAB this semester, and I think that I caught on pretty well to most of the topics. I have taken python in the past, and it was surprising how much of my coding experience transferred over to MATLAB. One thing I really enjoyed about this class is that there were only two exams, so I was not always stressed about studying. I also appreciated how the homework assignments and labs were not too strenuous, they required work, but it seemed that if you paid attention during class, you would be fine. The class was also kept interesting with occasional guest lectures and lectures about topics that were not MATLAB. The only thing that I would say I did not enjoy about the class would be Zybooks. While Zybooks were informative, they seemed a little repetitive of the lecture topics and sometimes seemed a little long and confusing. Other than that, I really enjoyed this class, and I am excited to use MATLAB in my future classes and career.

I (Aidan) have also thoroughly enjoyed this class this semester. I failed this class my freshman year and felt that the teaching style and approach were very poor. That has since changed greatly and the things I learn in class are easily applicable to my class work in chemical engineering. I thought the labs were straight forward and help was readily available, and the homework’s were challenging enough that it drove me to really improve my coding ability. I appreciate all the guest lectures and offhand important information that we are taught. Overall, it was a very positive experience.