

For the final project my partner, Khloe Parsons, and I decided to design a code using GUIs that would solve the Van der Waals equation for us. Khloe and I are both chemical engineering majors, and this semester we used the Van der Waals equation to solve for the specific volume of non-ideal gases in cases where the typical  $PV = nRT$  equation would not work. We wanted to design a code that would simplify the process and would take our input temperature and pressure values, convert them to the correct SI units if necessary, solve for the  $a$  and  $b$  constants used in the equation, and give us an output value that corresponds to specific volume. The LA that approved our project and helped us flesh out our UI controls was Laurel Hilger.

Our first priority when devising our code was our three unique UI controls and our two unique callback functions. The obvious callback function was “solve” as that was the primary goal of the code. For our second callback function we decided to write a code that would convert the temperature and pressure units to SI units if they were inputted in degrees Celsius and atmospheres, respectively. In terms of our UI controls we decided to implement text boxes for our input values, a button to press that runs the calculation, and drop down menus for selecting units for the temperature and pressure values.

After we outlined what we wanted to include in our code, we got to work writing it. The first part of the code creates text boxes and drop down menus for our known temperature/critical temperature and pressure/critical pressure values. This would allow the user to input the values for their non-ideal gas. The drop down menus allow the user to select which unit their values are given in. We then wrote a code for the solve button that is part of our GUI. The next part of the code was the callback function that converted units when necessary. Because the Van der Waals equation only works when temperature is in Kelvin and pressure is in Pascals, this function

would convert Celsius to Kelvin and Atmospheres to Pascals if that was what the user selected on the drop down menus. Then we defined the converted values as our values to use for the calculations. Finally, we created our specific volume function that would solve for specific volume using the converted input values. This function initially solved for the a and b constants used in the equation using the converted values. Then, we defined all variables and the function gave an output of specific volume. That is what the Van der Waals equation normally solves for.

Once we knew what we wanted in our code and got everything approved by Laurel, we started off pretty smoothly. The first part of the code that created the text boxes and drop down menus and buttons was pretty simple to construct and we were able to successfully run this. Things got more difficult when we tried to call the input values to use in our unit conversion callback function and then the solve callback function. It took a lot of trial and error and consultation of mathworks to figure out how to write those functions, but eventually Khloe was able to figure out how to run it successfully. One of the biggest issues I faced early on was actually just downloading Git Bash to my MacBook. I wasn't able to download it for Lab11, so I spent the first part of this project trying to download it and set up my repository. Once I had that done, Khloe and I were able to write our code together and test it until we got it to work.

At first I wasn't sure how or when I would use GUIs in the future, but after using GUIs through this project to create a program that solves an equation I use in my major, I think I could use GUIs to help make some of our calculations easier. We've already used MATLAB in chemical engineering to solve for roots and make computations easier, so I think I could continue to do that in the future. Especially with the text box UI controls I can input values and write code that would solve equations for me to make the process more efficient. Additionally, because GUIs are so visual, I think they are really helpful. I am a visual person; I like seeing information

organized in visually appealing ways. Overall, I think using GUIs can be really important in engineering careers because they allow higher productivity and simplify things.