

Again, you may work in groups of three for this homework.

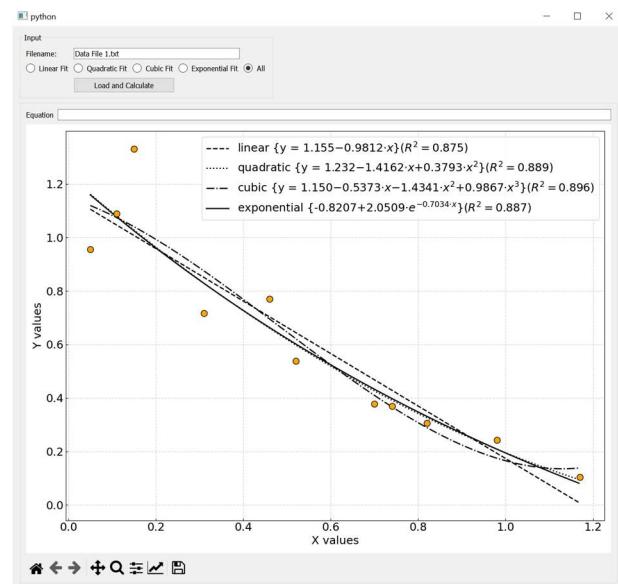
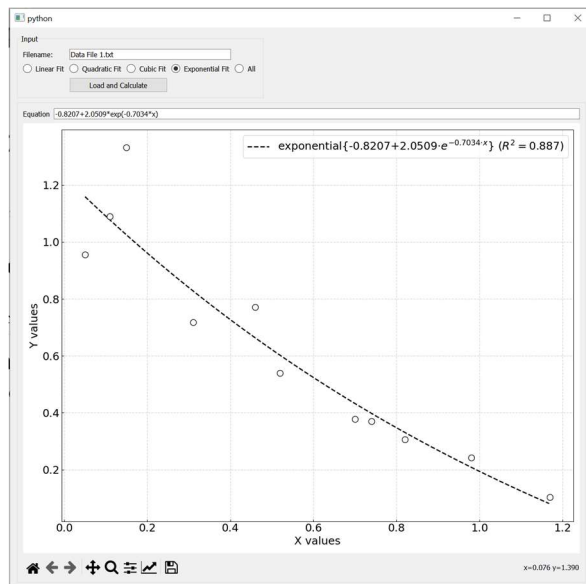
Problem 1: A curve fitting problem with `scipy.optimize.minimize()`

In Homework 4b, we plotted least squares fits to some existing data using both linear and cubic polynomials. This program has been put in object-oriented form and given significant functionality to open a data file and fit data using linear, quadratic and cubic polynomials. The fitting of data with an exponential equation (i.e., $f(x) = a + b \cdot e^{c \cdot x}$) has been “broken” in the `HW10_OOP_stem.py` file.

You should fix the code inside the functions:

```
def OptimizeFit(self): and def Exp(self, xval, a):
```

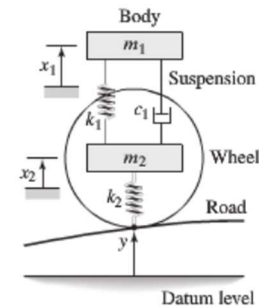
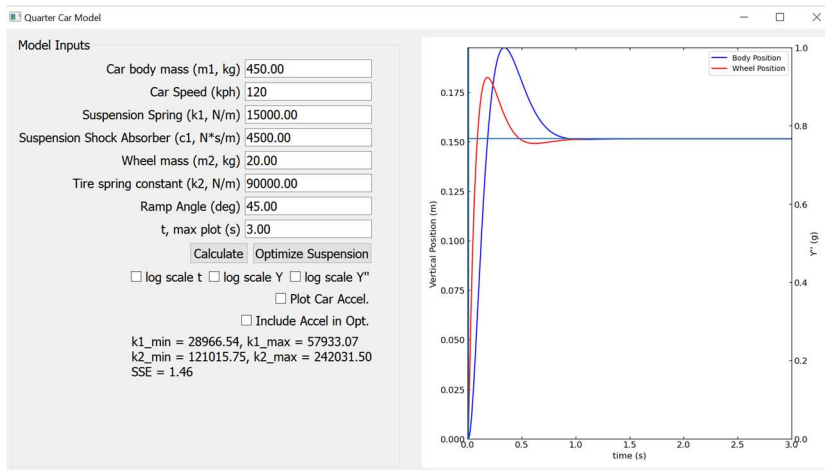
For the Exponential fit, you must use the ***minimize()*** function of `scipy.optimize` to find the three coefficients of the exponential equation and restore the program to full functionality



Problem 2: Optimizing the quarter car model (in English)

In Lecture 5, we used `scipy.integrate.odeint` to analyze the behavior of a Quarter Car Model (https://canvas.okstate.edu/courses/124110/files/13810645/download?download_frd=1).

In English, describe how you would optimize the suspension of the quarter car model using: `scipy.optimize.minimize`. Your discussion should be sufficiently explicit to translate into an object-oriented, MVC design pattern program with a GUI such as in the following picture:



For example, you might start with a statement like: "To analyze and optimize the quarter car model, with a program having a GUI and MVC design pattern, I need to: *i.* create a GUI using QTDesigner and pyuic5, *ii.* write a python file containing classes for `carModel`, `carController`, and `carView`, and *iii.* write a `car_App.py` file that instantiates a `carController` object... Details for steps *i*, *ii*, and *iii* are in the following paragraphs."

Some questions to consider might include: What data and functions should be in the `carModel` class? What functions should be in the `carController` class? What functions should be in the `carView` class? When the calculate button is pushed, what information from the GUI is passed to the `carController` object? What is calculated when you push the Calculate button? What happens when you push the Optimize Suspension button (i.e., which parameters are optimized and how)? What do you mean by optimize? Etc.

Note: a variant of this OOP, MVC, GUI program will be a question on Exam 3. Time invested here is well-spent.