BE CAREFUL WITH THE CODE, AS IT HAS THE POWER TO MODIFY THE PROGRAM OR DAMAGE YOUR COMPUTER IF USED INCORRECTLY.

Any valid Python code can be entered into the formula box. Clicking the Run fitting button will check the syntax of the code and then execute it.

The fitting algorithm will vary the parameters listed in the Fitting Parameters window. The names given to these parameters can be used and modified in the code. Parameters must be alphanumeric, cannot be duplicated, and cannot be a Python reserved word:

|  |  |  |
| --- | --- | --- |
| * and * as * assert * break * class * continue * def * del * elif * else * except | * finally * False * for * from * global * if * import * in * is * lambda * nonlocal | * None * not * or * pass * raise * return * True * try * with * while * yield |

Code can be commented by using the *#* sign, and long lines of code can be broken by placing *\* at the end of the line and then continuing on the next line.

Several variables and functions are predefined in the code:

* The frequencies from the input file can be accessed as an array named freq. For instance, to access the first frequency, use freq[0] in the code
* The imaginary part of the impedance is an array named Zj. For instance, to access the first imaginary impedance point, use Zj[0] in the code
* The real part of the impedance is an array named Zr. For instance, to access the first real impedance point, use Zr[0] in the code
* The imaginary number can be accessed as 1j
* The code should set variables named Zreal and Zimag to arrays of the values for the real and imaginary parts of the impedance, respectively. Each point in the array should correspond to the frequency at that index. For instance, Zreal[0] should be the real part of the model impedance evaluated at freq[0]
* If custom weighting is used, an array name weighting should be created with the weights by frequency; for instance, weighting[0] should be the weighting at freq[0]. Therefore, custom weighting is the same between the real and imaginary parts.
* Python built-ins can be used and packages can be imported; numpy is pre-imported as np
* Built-in functions include:
  + PI
  + SQRT
  + ABS
  + EXP [*ex* ]
  + SIN, COS, and TAN
  + ARCSIN, ARCCOS, and ARCTAN
  + SINH, COSH, and TANH
  + ARCSINH, ARCCOSH, and ARCTANH
  + LN and LOG [LN is base-*e*, LOG is base-10]
  + RAD2DEG and DEG2RAD

*Note: Trig functions take their arguments/return results in radians*

Code is automatically syntax highlighted. Supplied variables (Zr, Zj, and freq), fitting

variables, and result variables (Zreal, Zimag, and weighting) are highlighted red. Included functions, the imaginary number, and Python built-in functions are highlighted

purple. Strings are highlighted green, comments are highlighted gray, and Python reserved words are highlighted blue.

If imports are used, they must be either

**Example:**

We will fit one Voigt element:

1. First load a *.mmfile* under Browse…
2. Next, click Fitting Parameters, then click Add Parameter three times (one for each variable we will be fitting)
3. Rename var0 to Re, var1 to R1, and var2 to T1, and type their initial guesses into the boxes to the right
4. In the dropdown to the right of T1, select + to constrain the time constant to be positive
5. Set the desired fit type, number of Monte Carlo simulations, and weighting strategy (see the Measurement Model Guide link in the “Help and About” tab)
6. Enter the following into the Code window (the code should syntax-highlight as seen below):

Z = Re + R1/(1+1j\*2\*PI\*freq\*T1)

Zreal = Z.real

Zimag = Z.imag

1. Click Run fitting and wait for results to appear

**Synthetic Data:**

Synthetic data can be simulated by using the Synthetic data button next to the Run fitting button. This will use the existing parameters and values, as well as the current code, to generate data. The button will open a popup window where the upper and lower frequencies and number of data points per decade can be chosen. Clicking Generate synthetic data will then use the specified frequencies, along with code, parameters, and values to create data. The generated data will appear in a listbox underneath and from there can be saved, copied, or plotted.

**Fitting Models:**