

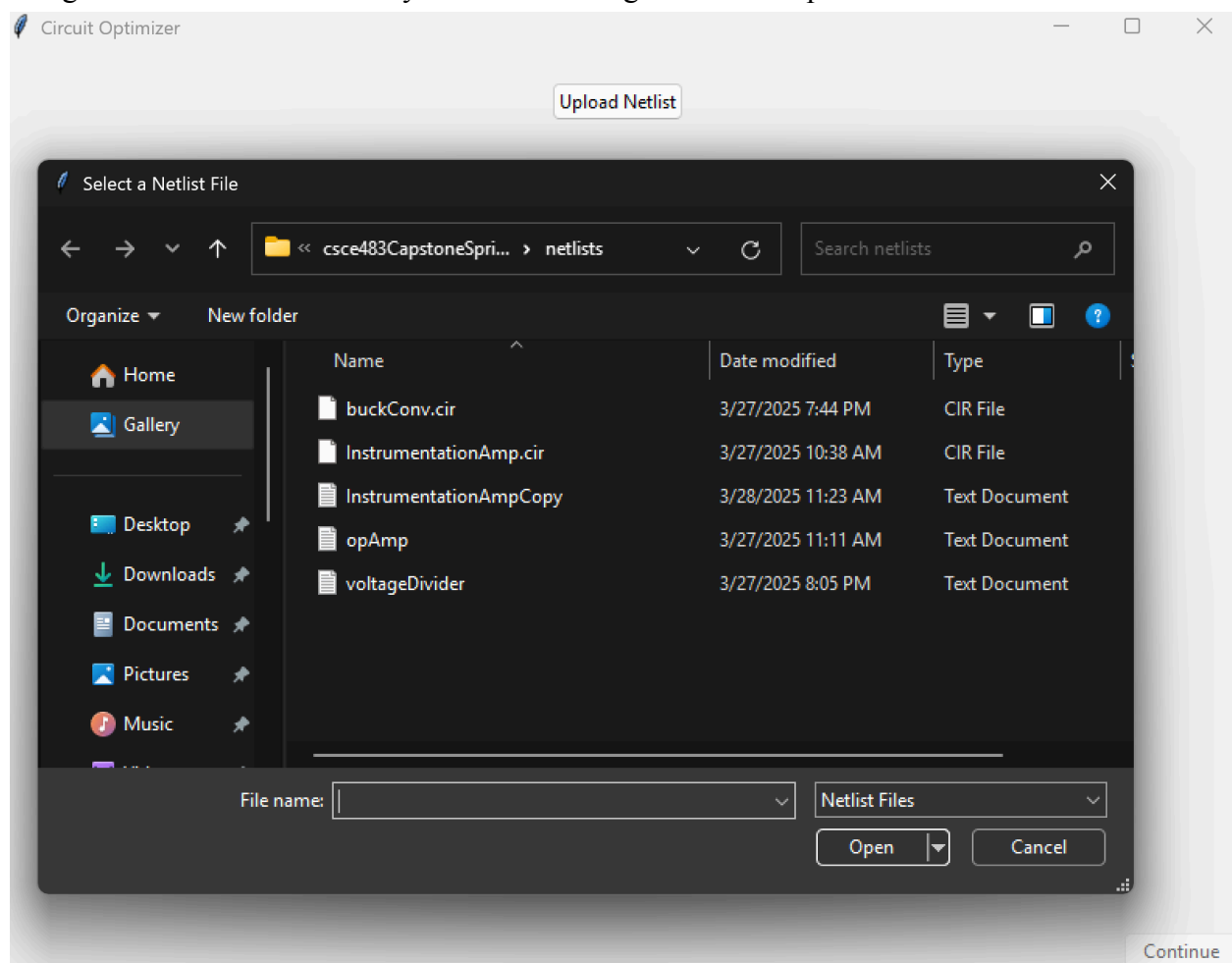
User Manual

Software Installation

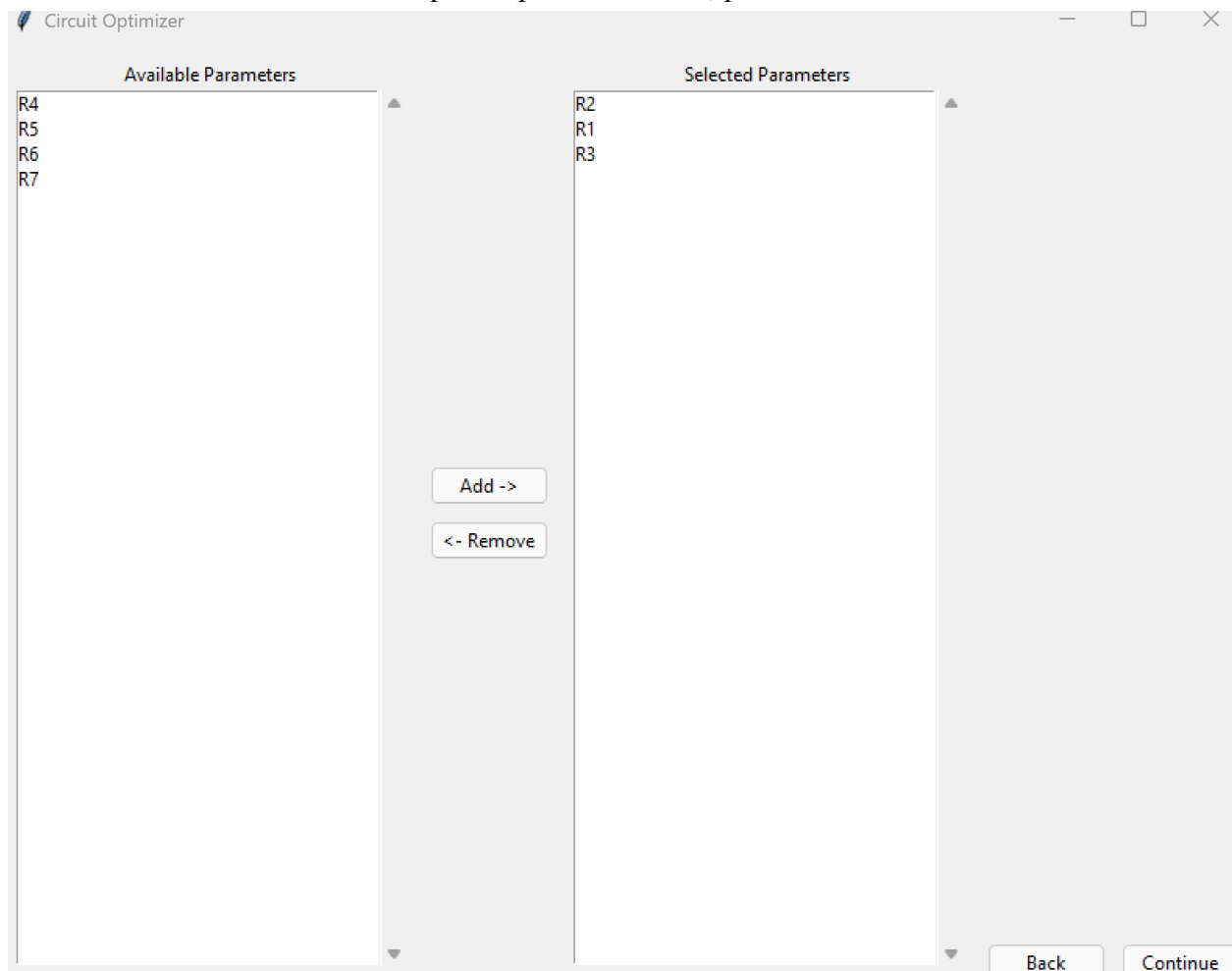
Our project consists of a Windows executable. Simply download the file, unzip the project, and run the executable. For our project, you will need a netlist written in Pspice syntax. We recommend using Qucs for a Windows schematic editor that plays nicely with Xyce. You can install Qucs using their website. In addition, your computer will also need to install Xyce. Xyce can be installed on Sandia's website. Xyce also needs to be in your path variable. Simply add the executable Xyce bin file in the path file. In order to check that Xyce is installed correctly, run the command `xyce -v` in the command line and make sure that command runs.

Operation Manual

To use our software first upload the netlist. Our software supports Netlists with syntax that is supported by Xyce. For a more detailed description of what features are supported check out the [reference guide](#). Please do not include `.tran` or `.print` commands in your netlist as our software will generate them automatically based on the target function input.



Select a valid netlist file and then press open. Afterward, press the continue button.



Parameters are R, L, or C values that can be optimized and changed. Select the parameters you want to optimize and move them to the selected parameters section. Parameters that are not selected will be kept at their original value and will not be optimized.

The screenshot shows the 'Circuit Optimizer' window. At the top, there are two dropdown menus: 'Optimization Type' set to 'Curve Fit' and 'Input Function Type'. Below these are two input fields for 'X Parameter' (set to 'time') and 'Y Parameter', each with an 'Expr...' button. A 'Constraints' section contains a table with three columns: 'Left', 'Operator', and 'Right'. Below the table are buttons for 'Add Constraint', 'Remove Constraint', 'Edit Constraint', 'Import Constraints', and 'Export Constraints'. At the bottom left is a 'Back' button, and at the bottom right is a 'Begin Optimization' button.

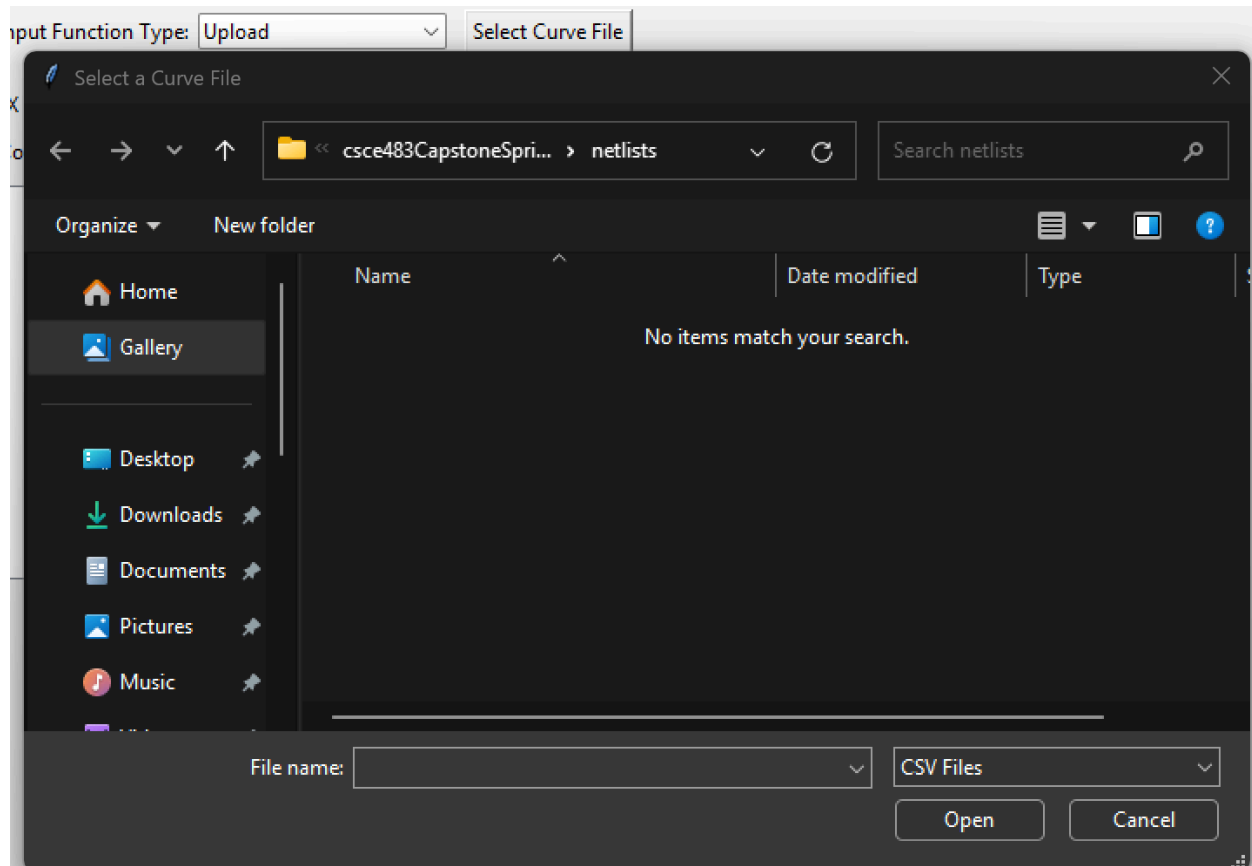
Here you specify the optimization settings. The target function is the type of the function that you want to optimize. The optimizer will try to make your Xyce output equal to the target function. When inputting your target function the specified x values will be the start and stop time of the transient simulation. The units are in seconds. We support three function types: line, heaviside, and custom function.

This form is for adding a line constraint. It consists of the text 'Slope =' followed by an input box, then 'From x =' followed by an input box, then 'to x =' followed by an input box, and finally an 'Add Line' button.

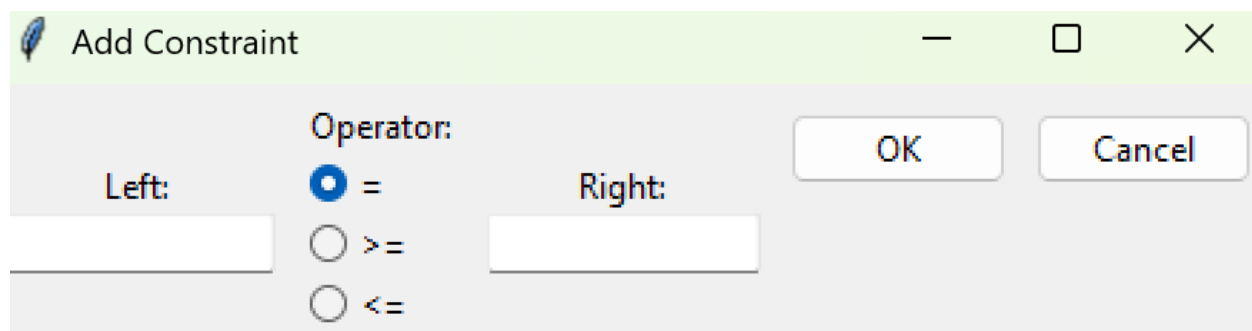
For the line type input the slope as well as the start and stop value for the line and then press Add Line.

This form is for adding a heaviside constraint. It consists of the text 'Amplitude =' followed by an input box, then 'From x =' followed by an input box, then 'to x =' followed by an input box, and finally an 'Add Heaviside' button.

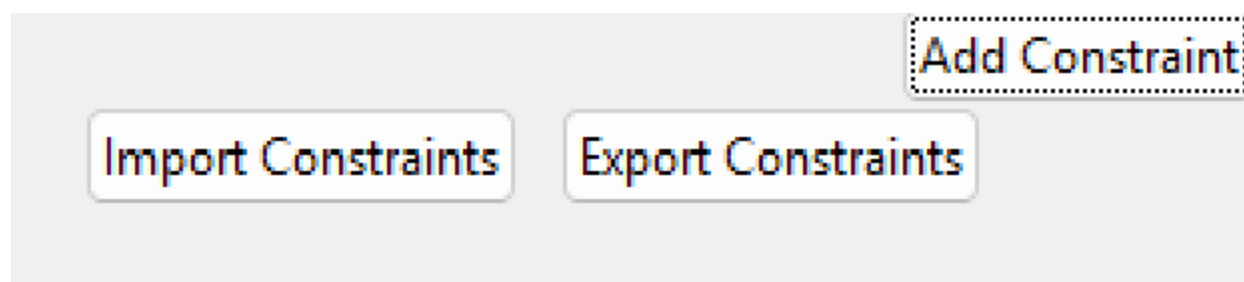
For the Heaviside set the Amplitude, start and stop values, and then press the Add Heaviside button.



For Custom, press the upload button and then select a CSV file that has a function you want to optimize with. The Y-parameter should be the voltage that you want to optimize the function to. The units for the x axis will be seconds.



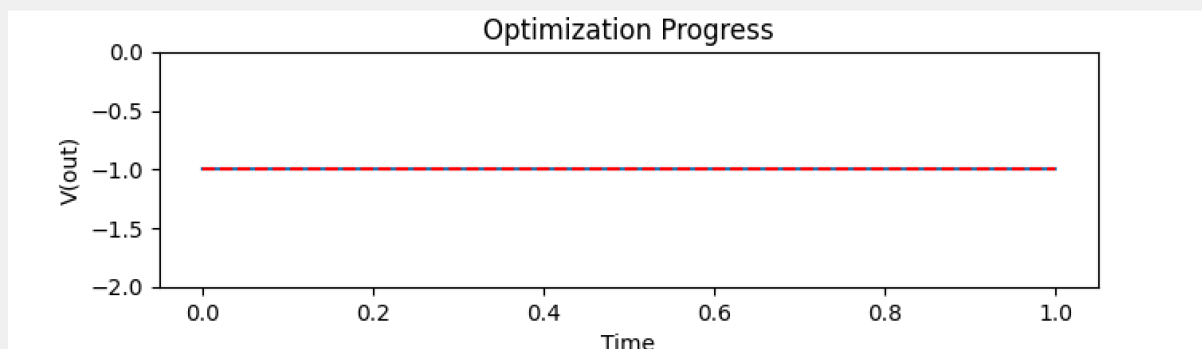
Press Add constraint to add a constraint. Constraints allow you to bound certain values for your optimization. On the left side you are allowed to put either an optimization parameter (one of the R, L, or C values you selected in the earlier page) or a voltage node. If you put an optimization parameter \leq or \geq support only constant numbers on the right side. If you have an optimization parameter (R,L,or C value) and put $=$ you can put mathematical expressions featuring constants as well as additional optimization parameters (R, L, or C values). If you put a voltage node you can only use \leq or \geq . $=$ Does not work for voltage nodes. In addition the right side can only be a constant value. If you input an invalid constraint the program will error and let you know.



You can also import and export constraints using the buttons below. Imported and exported constraints only work for the same netlist.

Optimization In Progress

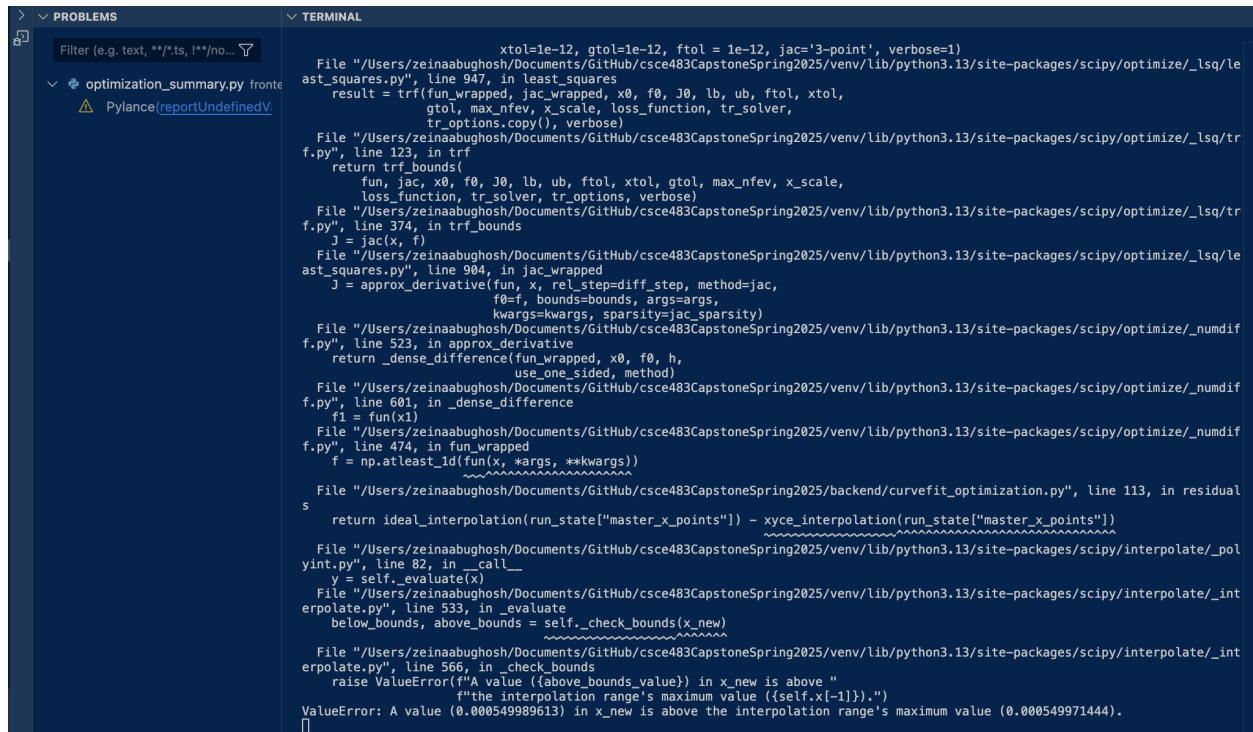
Parameter	Value
Update:	Optimization Results: [40, 8, 51.273, 0.0, 0.0]
Update:	total runs completed: 40
Update:	total runs completed: 35
Update:	total runs completed: 30
Update:	total runs completed: 25
Update:	total runs completed: 20
Update:	total runs completed: 15
Update:	total runs completed: 10
Update:	total runs completed: 5



Close

Afterward, the optimization will be complete. The optimized netlist will be present as a copy in the original directory where the netlist is located, with copy.txt added to the end of the file.

Common Errors



```

    xtol=1e-12, gtol=1e-12, ftol = 1e-12, jac='3-point', verbose=1)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_lsq/least_squares.py", line 947, in least_squares
    result = trf(fun_wrapped, jac_wrapped, x0, f0, J0, lb, ub, ftol, xtol,
              gtol, max_nfev, x_scale, loss_function, tr_solver,
              tr_options.copy(), verbose)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_lsq/trf.py", line 123, in trf
    return trf_bounds(
        fun, jac, x0, f0, J0, lb, ub, ftol, xtol, gtol, max_nfev, x_scale,
        loss_function, tr_solver, tr_options, verbose)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_lsq/trf.py", line 374, in trf_bounds
    J = jac(x, f)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_lsq/least_squares.py", line 904, in jac_wrapped
    J = approx_derivative(fun, x, rel_step=diff_step, method=jac,
                        f0=f, bounds=bounds, args=args,
                        kwargs=kwargs, sparsity=jac_sparsity)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_numdiff.py", line 523, in approx_derivative
    return _dense_difference(fun_wrapped, x0, f0, h,
                            use_one_sided, method)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_numdiff.py", line 601, in _dense_difference
    f1 = fun(x1)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/optimize/_numdiff.py", line 474, in fun_wrapped
    f = np.atleast_1d(fun(x, *args, **kwargs))
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/backend/curvefit_optimization.py", line 113, in residual
    return ideal_interpolation(run_state["master_x_points"]) - xyce_interpolation(run_state["master_x_points"])
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/interpolate/_polynomial.py", line 82, in __call__
    y = self._evaluate(x)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/interpolate/_interpolate.py", line 533, in _evaluate
    below_bounds, above_bounds = self._check_bounds(x_new)
File "/Users/zeinaabughosh/Documents/GitHub/csce483CapstoneSpring2025/venv/lib/python3.13/site-packages/scipy/interpolate/_interpolate.py", line 566, in _check_bounds
    raise ValueError(f"A value ({above_bounds_value}) in x_new is above "
                    f"the interpolation range's maximum value ({self.x[-1]}).")
ValueError: A value (0.000549989613) in x_new is above the interpolation range's maximum value (0.000549971444).

```

If you get an error in the command prompt and the optimization summary page that talks about how a value is outside the interpolation range, that means that the Xyce run terminated prematurely. Usually the case of this is that the circuit parameters are too unrealistic to be simulated. The fix for this error is to add constraints to the circuit that make sure that each possible iteration of the circuit can be solved. You can see the netlist values that Xyce errored on by viewing the copy of the netlist file.

