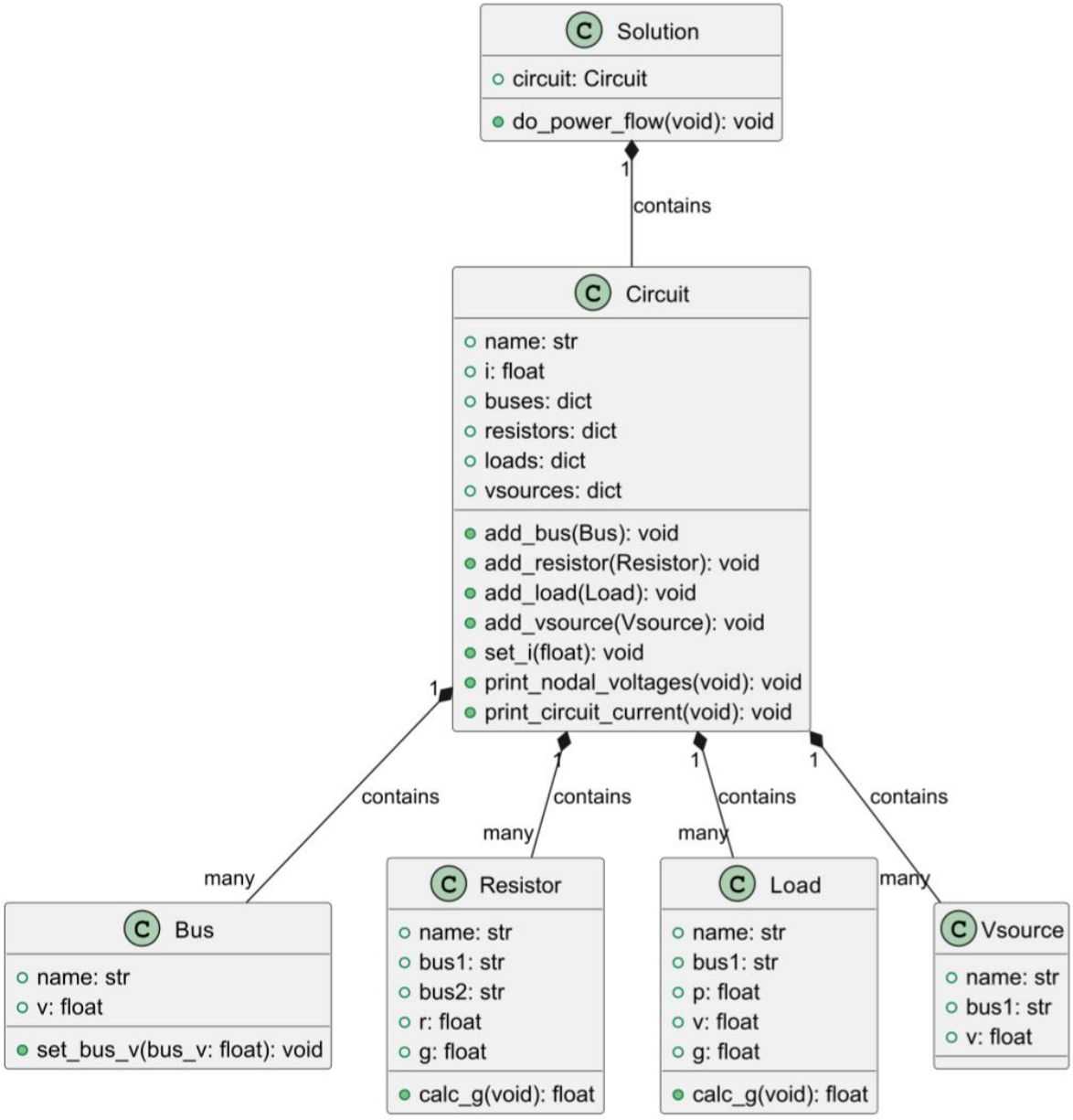
Jack Bonney

ECE 2774

Project 1: Simple Circuit Documentation

Simple Circuit is a python package that lets you solve a basic linear circuit by using defined buses, loads, resistors and a voltage source. It works for simulating and solving DC circuits, and is useful for introductory circuit classes and labs, this one uses a one resistor linear circuit with a set DC source and load and is useful for modeling basic circuits.

Class Diagram Flowchart



Relevant Equations

Ohm's Law:

V = I*R; V = Voltage (Volts), I = Current (Amps), R = Resistance (Ohms)

Power-Voltage Relationship:

P = VI, P = (V^2)/R; V = Voltage (Volts), I = Current (Amps), R = Resistance (Ohms), P = Power (Watts)

Conductance Calculations:

G = 1/R, R = (V^2)/P; G = Conductance (Siemens), R = Resistance (Ohms), V = Voltage (Volts), P = Power (Watts)

Kirchhoff's Voltage Law

Vsource – V1 – V2 - … - Vn = 0; The sum of all voltages in a closed loop in a circuit is 0

Example Case

The example problem starts with the 3 known elements, a 20V source connected to Bus A, a 100 Ohm resistor between Bus A and Bus B, and a load connected to Bus B with a power of 3000W and a nominal voltage of 20V.

The first portion is solving for the bus voltages. This starts with first creating a class instance for Both Buses and Circuit, before adding the buses to the circuit. After this, the Source, Resistor and Load are created connected to their respective buses before adding the components to the circuit. Once this is done, a solution instance is created using the circuit instance, and then the power flow solver is called.

The solver first works by first getting the class instances in the circuit. Once obtained, it then finds the current in the circuit using the formula:

$$\mathbf{I_{Circuit} = V_{Source} / (R_{Resistor} + 1/G_{Load}) \Rightarrow I_{Circuit} = 0.1997\ A}$$

Once the current is obtained, the voltage for bus B is calculated through the equation

$$\mathbf{V_B = I_{Circuit} * 1/G_{Load} \Rightarrow V_B = 0.0266\ V}$$

While V_A is equal to the voltage of the source, in this case being $\mathbf{V_A = 20\ V}$