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ECSE343 Group Project 2 Report

The goal of this project is to design a simulation that simulates the behavior of transient response of a half-wave rectifier circuit in Figure 1

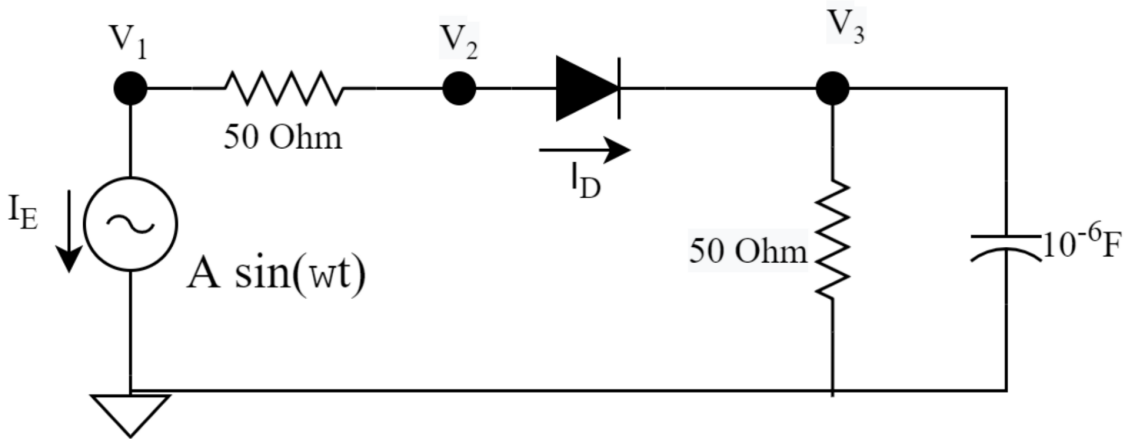

Figure 1: Half-Wave Rectifier.

We first implement two functions “evaluateJacobian” and “evaluateEquations” that perform the methods mentioned in the instruction document. Then in the body, we use a while loop to check the tolerance requirement. it keeps looping through the two functions until the output matches the tolerance.

In addition to the while loop, we used a for loop to compute every data point within the 0 -- 0.5 second range.

As the requirement, we set the t stop at 0.5 second and dt = 10^-4, and we started by guessing X(0) as a vector of zeros. This works out pretty well. We also tested other initial X values. The algorithm works for other values until the initial guessed value is too large, it fails and matlab reports some error.

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Warning: Matrix is singular, close to singular or badly
scaled. Results may be inaccurate. RCOND = NaN.
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scaled. Results may be inaccurate. RCOND = NaN.
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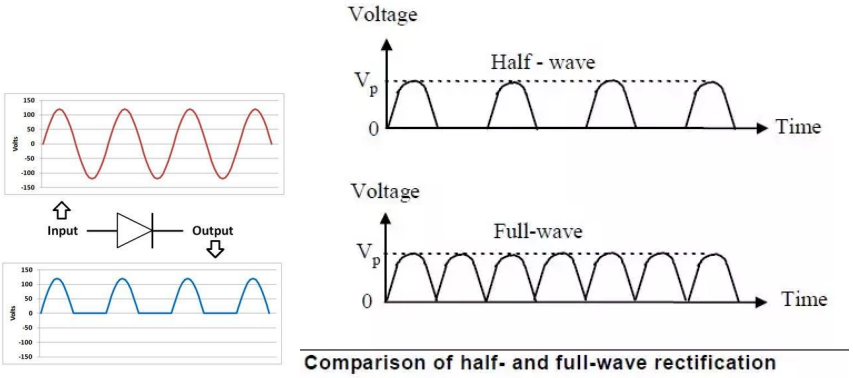
scaled. Results may be inaccurate. RCOND = NaN.
```

Since the voltage obtained at V3 is always positive, therefore performing the task of a half-wave rectifier, of filtering the V<0 parts, it is also consistent with diode response. We also looked online at the normal diode AC response and half-wave rectifier voltage graph (as shown by the images below), and it is similar to our result. This means that our design is doing a reasonable task.



Comparison of half- and full-wave rectification

Also, we observe that in the plot |V1|>|V2|>|V3|, which is also consistent with the expected circuit behavior. (shown in the figure below, obtained in our plot)