ENGN1218 Introduction to Electronics
Full-wave Rectifier Analysis

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October 23, 2014

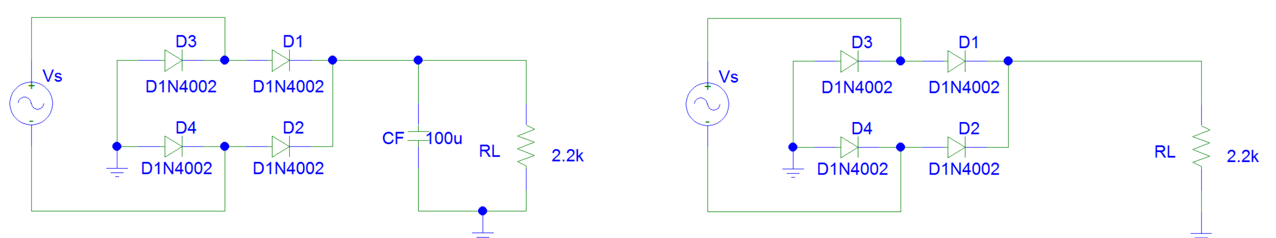
Abstract

A diode-bridge full wave power rectifier circuit was designed and constructed. The aim was to achieve a 12V DC output with 10% tolerance. A theoretical analysis of two types of diode-bridge full-wave rectifiers—with and without a capacitor—was conducted, and results confirmed using a computer simulation. The construction process was documented, and all output parameters measured. The aim was successfully achieved, with all output parameters matching the predicted values within an acceptable error bound.

1 Introduction

2 Theoretical Analysis

Two versions of a full-wave rectifier circuit were analysed, with and without a smoothing capacitor, schematics shown in Figures 1a and 1b respectively.



(a) Full-wave rectifier with a capacitor filter.   (b) Full-wave rectifier without a capacitor filter.

Figure 1: Schematics.

To predict the output of the rectifier circuit, formulas from the textbook were used (**?**). The value for the input voltage V_{in}[1] was taken to be equal to the actual output of the transformer used during testing (see Section 4). The output voltage of a rectifier without a capacitor filter was

[1]Unless explicitly stated otherwise, all AC voltage values are peak-to-peak.

calculated in Equation 1, and the voltage ripple of the output of the rectifier with a smoothing capacitor—in Equation 2.

$$\begin{aligned} V_{out} &= V_{in} - 2 \times 0.7 \\ &= 18.8 - 1.4 \\ &= 17.4\text{V} \end{aligned} \tag{1}$$

Note that in the above case, in the absence of the smoothing capacitor, $V_r = V_{out}$. The addition of a capacitor has no effect on the output peak voltage, but decreases ripple.

$$\begin{aligned} V_r &= \frac{V_{out}}{2fR_LC} \\ &= \frac{17.4}{2 \times 50 \times 2.2 \times 10^3 \times 10^{-4}} \\ &\approx 0.79\text{V} \end{aligned} \tag{2}$$

3 Simulation

4 Implementation

5 Discussion

6 Conclusion

References

James W. Nilsson and Susan A. Riedel. *Electric Circuits*. Pearson.