Electric Circuits

An Introduction

Robert Brown
Darby Hewitt

February 5, 2019

Dedicated to some cool people.

Contents

Preface

This book is made in reaction to many introductory Electrical Engineering texts, which tend to assume a Sophomore- or even Junior-level understanding of Mathematics. In contrast, we aim our text at Freshmen, who may or may not have completed Calculus I.

Acknowledgements

- To Robert and Darby, who are awesome!
- To the students, who are awesome!
- To circuits, which is awesome!

1

Underlying Fundamentals

Part I

DC Circuit Analysis

2

The First Laws

2.1 Ohm's Law on a Single Resistor

2.2 Ohm's Law on a Simple Circuit

2.3 Kirchoff's Current Law

2.4 Watt's Law

3

Circuit Simplification and Re-Expansion

4

Extra Uses for Voltage Dividers

4.1 Maximum Power Transfer

4.2 Nonlinear Circuit Elements

5

Operational Amplifiers

5.1 What is an Op-Amp?

5.2 Golden Rules

5.3 Analyzing Circuits with Op-Amps

Part II

Alternating Current

6

AC Circuits

6.1 Phasor Notation

6.2 Capacitors

6.3 Inductors

6.4 Impedance and Ohm's Law

7

Passive Filters

8

Active Filters

8.1 Op-Amps in AC

8.2 First Order Filters

8.3 Second Order Filters

Part III

Analysis of Complex Circuits

9

Node Voltage Method

10

Mesh Current Method