

Section E **Operational Amplifiers (Op-Amps)**

Section E1: Introduction & Goals

Throughout this semester, we have been going through an evolutionary process. We started with basic material physics, made a two-terminal device (diode) and messed with that for a while, and ended up with the first of the three terminal devices that we will be studying (the BJT, of course!). Although it may have been somewhat painful at times, I hope you have come to appreciate how important this area of our profession is and how powerful basic concepts and techniques may be.

With that little piece of personal philosophy out of the way, we are going to spend the rest of this semester looking at a ubiquitous (good word – look it up – I first saw it on a billboard in Kansas about 30 years ago) example of the application of the simple transistor. Specifically, we will be working with the **operational amplifier** (or **op-amp**), an extremely important entity in electronics. Although we will be referring to the op-amp as a device, it is actually our first example of an **integrated circuit** (IC). An IC, by definition, is created whenever more than one element (transistor, resistor, capacitor, inductor, etc.) is placed on a single chip. The IC may then replace standard circuits and may serve as building blocks for more complex systems.

In this section of our studies, we will be considering the operational amplifier as a unique device or circuit element. After completing this section, you should be familiar with:

- ∅ the characteristics of the ideal operational amplifier;
- ∅ representative models of the operational amplifier;
- ∅ how to use the operational amplifier to create amplifier circuits;
- ∅ the distinction and applications of inverting and non-inverting amplifiers;
- ∅ input and output characteristics of operational amplifier circuits;
- ∅ the design of multiple-input amplifiers; and
- ∅ how to design more complicated operational amplifier circuits to perform specific functions.

Note: Although this sounds like a pretty heavy way to end the semester, be of good cheer! The op-amp is such a well-behaved creature and we're going to be looking at the ideal case only in this section, so these last couple of weeks should be gravy!

