Electronic Circuit Design - with Bipolar and MOS Transistors (Electrical and Electronic Engineering Design Series) (Volume 2)

Nicholas L. Pappas Ph.D.

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Electrical and Electronic Engineering Design Series

This university level Electrical Engineering text is for anyone who wants to know how to design electronic circuits. The present text is unusually accessible to readers who want to acquire the skills of electronic circuit design. We present a thorough foundation so that you can proceed to learn how to design any circuit.

This text is different from other electronic circuit design texts, because we actually design circuits, and not just talk about them. And, we ask you to work hard doing experiments so that you acquire real world experience with commercially available electronic circuits. This is about real learning.

Eight experiments are included that give life to the text's contents, and provide the reader with real world experience with making measurements, using instruments, and learning about all kinds of parts. We consider the experiments to be significant learning activities.

Furthermore you will learn how to design and include in your electronic circuits multistage amplifiers, feedback amplifiers. operational amplifiers, tuned amplifiers, and oscillators, basic digital circuits, and vacuum tube circuits.

Electronic circuits are designed in two basic forms. One form uses discrete parts placed on a printed circuit board. The second form is an integrated circuit placed on a silicon chip.

There are two major classes of transistors in use today. BJT bipolar junction transistors and MOS field effect transistors. We leave the why of device physics to semiconductor texts.

We explain the BJT transistor AC and DC properties. We show how to design current mirror and differential amplifier BJT analog building blocks that are widely used in complex BJT analog IC circuits.

We explain resonant circuits so that we can show how to design elementary filters, tuned amplifiers, and oscillators.

The MOS transistor AC and DC properties are explained. We show how to design, in integrated circuit format, current mirror and differential amplifier MOS analog building blocks. We show how to design an operational amplifier, an LC tuned circuit amplifier, an LC oscillator, a CMOS digital inverter, and a CMOS 2 input NAND gate.

We explain feedback as Bode conceived it. We place the BJT and MOS amplifiers we designed into feedback structures, and apply Nyquist's Stability Theory to the amplifiers. And, feedback circuit design is illustrated by designs of one and two stage BJT feedback amplifiers, MOS voltage feedback amplifiers (VFA), and a BJT current feedback amplifier (CFA).

Two basic types of op amp are the voltage feedback amplifier (VFA), and the current feedback amplifier

(CFA).The useful ideal and realistic properties of VFA and CFA are made clear so that one can design circuits using them.

The text includes extensive use of the Spice simulation program to produce frequency domain response plots of sinewave input signals, input DC voltage to output DC voltage transfer function plots, and output transient time domain response plots of modified input signal waveforms. The plots give life to the circuit equations so that you can “see” circuit performance. The text shows how you can leave the number crunching to Spice so that you can focus on your designs.

We show how to write Spice programs that illustrate direct voltage and current (DC) analysis, alternating voltage and current (AC) analysis, and transient (TRAN) analysis.

The presentations are eminently clear, because they are based on the policies assume nothing and nothing is obvious.

The present text's contents are topics one actually uses when engaged in electronic circuit analysis and design.

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