An overview of analog signal processing was presented in Section 1.3. The objective of most analog circuits was seen to be the implementation of some sort of analog signal processing. The important concepts of circuit application, circuit technology, and system bandwidth were introduced and interrelated, and it was pointed out that analog circuits rarely stand alone but are usually combined with digital circuits to accomplish some form of signal processing. The boundaries between the analog and digital parts of the circuit depend on the application, the performance, and the area.

Section 1.4 gave an example of the design of a fully integrated disk-drive read-channel circuit. The example emphasized the hierarchical structure of the design and showed how the subjects to be presented in the following chapters could be used to implement a complex design.

Before beginning the study of the following chapters, the reader may wish to study Appendix A, which presents material that should be mastered before going further. It covers the subject of circuit analysis for analog circuit design, and some of the problems at the end of this chapter refer to this material. The reader may also wish to review other subjects, such as electronic modeling, computer simulation techniques, Laplace and z-transform theory, and semiconductor device theory.

Problems

1.1-1. Using Eq. (1.1-1), give the base-10 value for the 5-bit binary number 11010 ($b_4b_3b_2b_1b_0$ ordering).

1.1-2. Process the sinusoid in Fig. P1.1-2. through an analog sample and hold. The sample points are given at each integer value of t/T.

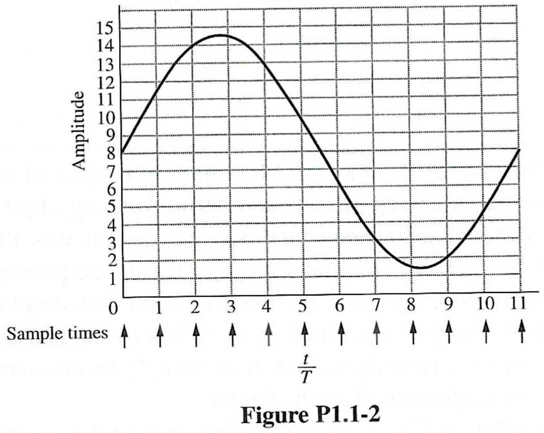

Figure P1.1-2

1.1-3. Digitize the sinusoid given in Fig. P1.1-2 according to Eq. (1.1-1) using a 4-bit digitizer.

The following problems refer to material in Appendix A.

1.1-4. Use the nodal equation method to find v_{out}/v_{in} of Fig. P1.1-4.

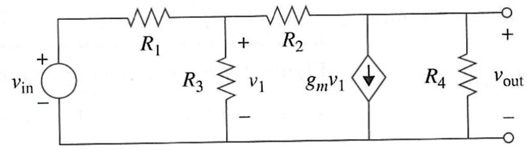

Figure P1.1-4

1.1-5. Use the mesh equation method to find v_{out}/v_{in} of Fig. P1.1-4.

1.1-6. Use the source rearrangement and substitution concepts to simplify the circuit shown in Fig. P1.1-6 and solve for i_{out}/i_{in} by making chain-type calculations only.

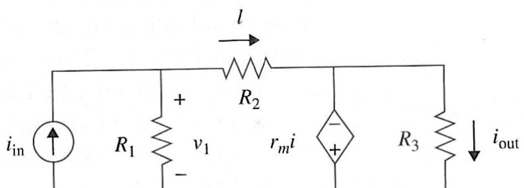

Figure P1.1-6

[illegible] Find v_2/v_1 and v_1/i_1 of Fig. P1.1-7.

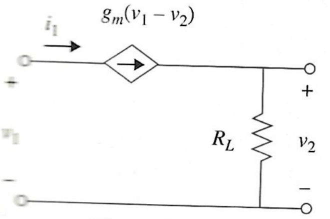

Figure P1.1-7

[illegible] Use the circuit-reduction technique to solve for v_{out}/v_{in} of Fig. P.1.1-8

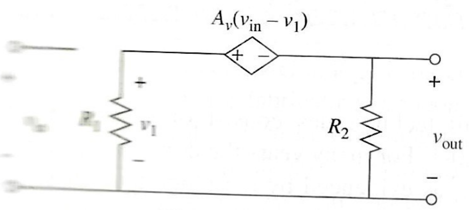

Figure P1.1-8

1.1-9. Use the Miller simplification concept to solve for v_{out}/v_{in} of Fig. A.1-3 (see Appendix A).

1.1-10. Find v_{out}/i_{in} of Fig. A.1-12 and compare with the results of Example A.1-1.

1.1-11. Use the Miller simplification technique described in Appendix A to solve for the output resistance, v_o/i_o, of Fig. P1.1-4. Calculate the output resistance not using the Miller simplification and compare your results.

1.1-12. Consider an ideal voltage amplifier with a voltage gain of $A_v = 0.99$. A resistance $R =$ 50 kΩ is connected from the output back to the input. Find the input resistance of this circuit by applying the Miller simplification concept.

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