1. Determine the closed-loop transfer function $H(s)$ and its gain at $f = 0$.
2. For what range of value of τ_1 and K is the loop stable?

7.40 The loop filter $G(s)$ in a PLL is implemented by the circuit shown in Figure P-7.40. Determine the system function $G(s)$ and express the time constants τ_1 and τ_2 [see Equation (5.2.4)] in terms of the circuit parameters.

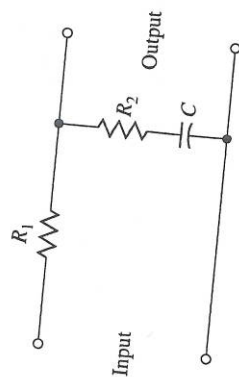Figure P-7.40

7.41 The loop filter $G(s)$ in a PLL is implemented with the active filter shown in Figure P-7.41. Determine the system function $G(s)$ and express the time constants τ_1 and τ_2 [see Equation (5.2.4)] in terms of the circuit parameters.
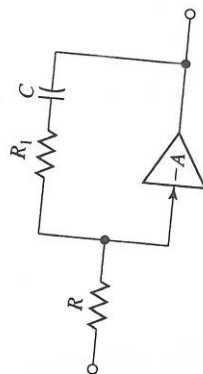

Figure P-7.41

7.42 Consider the four-phase and eight-phase signal constellations shown in Figure P-7.42. Determine the radii r_1 and r_2 of the circles, such that the distance
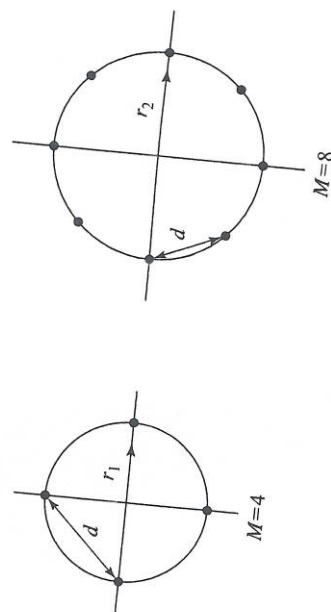

Figure P-7.42

between two adjacent points in the two constellations is d. From this result, determine the additional transmitted energy required in the 8-PSK signal to achieve the same error probability as the four-phase signal at high SNR, where the probability of error is determined by errors in selecting adjacent points.

7.43 Consider the two 8-point QAM signal constellation shown in Figure P-7.43. The minimum distance between adjacent points is $2A$. Determine the average transmitted power for each constellation assuming that the signal points are equally probable. Which constellation is more power efficient?
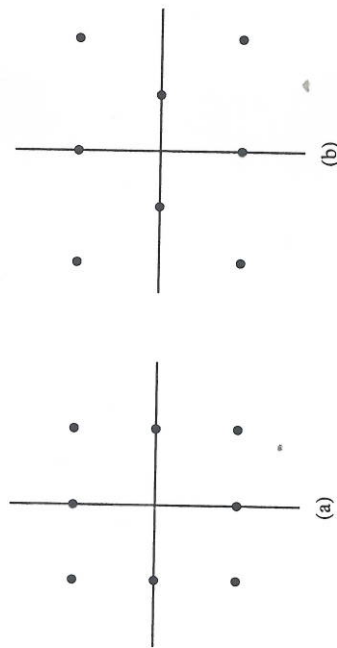

(a)   (b)

Figure P-7.43

7.44 The 16-QAM signal constellation shown in Figure P-7.44 is an international standard for telephone-line modems (called V.29). Determine the optimum decision boundaries for the detector, assuming that the SNR is sufficiently high so that errors only occur between adjacent points.

7.45 Specify a Gray code for the 16-QAM V.29 signal constellation shown in Problem 7.44.

7.46 Consider the octal signal-point constellations in Figure P-7.46.

1. The nearest neighbor signal points in the 8-QAM signal constellation are separated in distance by A units. Determine the radii a and b of the inner and outer circles.

2. The adjacent signal points in the 8-PSK are separated by a distance of A units. Determine the radius r of the circle.

3. Determine the average transmitter powers for the two signal constellations and compare the two powers. What is the relative power advantage of one constellation over the other? (Assume that all signal points are equally probable).

7.47 Consider a digital communication system that transmits information via QAM over a voice-band telephone channel at...