

Problems for Tutorial - 7

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- 1) Problem 4.2 in text book.
- 2) Study and describe the demodulation of FM signals using a "frequency discriminator" discussed in the textbook.

Is this a coherent or a non-coherent demodulator?

- 3) In a stereo FM signal, the two distinct messages $m_e(t)$ and $m_r(t)$ are frequency division multiplexed (FDM) into a single message signal $m(t)$ as

$$m(t) = [m_e(t) + m_r(t)] + [m_e(t) - m_r(t)] \cos 4\pi f t + k \cos 2\pi f t \quad \text{--- (1)}$$

where $f = 19 \text{ kHz}$, $m_e(t)$ and $m_r(t)$ are band limited to $[-19 \text{ kHz}, 19 \text{ kHz}]$.

$m(t)$ is then transmitted using frequency modulation, i.e.,

$$s_{FM}(t) = \cos \left(2\pi f_c t + 2\pi k_f \int_0^t m(x) dx \right) \quad \text{--- (2)}$$

The signal received is

$$r(t) = s_{FM}(t - \tau)$$

From $r(t)$ we can recover $m(t - \tau)$

using either a PLL or a frequency discriminator.

Describe how to recover $m_e(t - \tau)$ and

$m_r(t - \tau)$ from $m(t - \tau)$? Explain all

the steps clearly.