EE 308: Communication Systems

Homework 3

1. We have covered the all sections from Chapter 4 of the text.
2. As you read through Chapter 4, you are also expected to understand the solved examples in these sections of the text.
3. Also, solve the drill problems in the text as you read through the chapter.
4. End of chapter problems from Chapter 4: 4.9, 4.11, 4.12, 4.13. 4.15, 4.18
5. An FM carrier is sinusoidally modulated. For what value of β does all the power lie in the sidebands, i.e., no power in the carrier.
6. A carrier frequency is modulated by a 2KHz sinusoid resulting in a frequency deviation of 5KHz. What is bandwidth occupied by the modulated waveform. The amplitude of the modulating waveform is increased by a factor of 3 and its frequency is lowered to 1KHz. What is the new bandwidth.
7. Claim: Superposition applies in narrowband FM. This means that if the modulating signal $m(t) = \beta_1 \sin(2\pi f_1 t) + \beta_2 \sin(2\pi f_2 t)$, then the resulting sideband is the sum of the sidebands when $\beta_1 \sin(2\pi f_1 t)$ and $\beta_2 \sin(2\pi f_2 t)$ are used alone as the modulating signals. Show this as follows. Let

   $$s(t) = \cos(2\pi f_c t + m(t)).$$

   If β_1 and β_2 are sufficiently small (how small) then argue that

   $$s(t) \approx \cos(2\pi f_c t) - (\beta_1 \sin(2\pi f_1 t) + \beta_2 \sin(2\pi f_2 t)) \sin(2\pi f_c t)$$