Comms IV 2008: Contact Details

Dr Mark McDonnell
• Institute for Telecommunications Research
• University of South Australia
• Mawson Lakes Campus
• http://people.unisa.edu.au/Mark.McDonnell

Questions about my lectures/tutorials:
• use my Uni. Adelaide email:
• mmcdonne@eleceng.adelaide.edu.au

Comms IV (Wednesday 19th March)
Next three weeks

• Schedule for 17th March-4th April
  • Monday 17th March, Section 3 (AM)
  • Wednesday 19th March, Section 3 (FM)
  • Friday 21st March, public holiday
  • Monday 24th March, public holiday
  • Wednesday 26th March, Section 4 (random processes)
  • Friday 28th March, Section 4 (random noise)

• Monday 31st March, Tutorial 2 (Sections 3 and 4)
  • Wednesday 2nd April: Derek Abbott resumes, Section 5
  • Friday 4th April: Derek Abbott, Section 5

Today’s Lecture: Section 3

• Key concepts for Section 3
  – Some more on SSBSC
    • In phase and Quadrature
    • Hilbert transform
  – Frequency Modulation
    • Instantaneous frequency
    • Peak frequency deviation
    • Modulation index for FM
    • Carson’s rule for FM bandwidth

Some more on SSBSC

• What is in-phase and quadrature?

• Why does a SSBSC signal have half the bandwidth?

• Above answered on whiteboard
Frequency modulation

• Important things you need to know (FM):
  – How FM encodes the varying amplitude of a message
  – How the envelope amplitude of an FM signal is different from AM
  – How the transmit power, and the bandwidth for FM compares with that of AM
  – Tradeoff between Bandwidth and modulation index for FM

FM Definitions

• Instantaneous frequency, \( f_i \)
• Peak frequency deviation, \( f_d \)
• FM modulation index, \( \beta = f_d / W \)
• Carson’s rule: \( B \approx 2(f_d + W) \)

Frequency modulation: recap

• Important things you need to know (FM):
  – The amplitude is represented by instantaneous frequency
    • Time between zero crossings represents amplitude
  – FM has no envelope; the peaks are always equal to \( A \).
    • This means the transmit power is constant with time and does not vary with \( m(t) \)
    • This is one reason why SNR performance is better (Section 5)
  – Bandwidth is larger than AM
    • Theoretically infinite bandwidth
    • In practice, bandwidth is a function of \( f_d \)

Frequency modulation: recap

• Important things you need to know (FM):
  – Increasing \( f_d \) (and hence the bandwidth) will increase the SNR (Section 5)
  – Have a tradeoff between bandwidth and SNR that is not possible with AM
  – The "cost" compared to AM is that FM requires more complicated transmitters and receivers than FM, and larger average power
• Comparison between AM types and FM
  – Done on whiteboard (see podcast)