EET-2170: SIGNAL ANALYSIS

Cuyahoga Community College

Viewing: EET-2170 : Signal Analysis

Board of Trustees:
May 2023

Academic Term:
Fall 2023

Subject Code
EET - Electrical/Electronic Engineer

Course Number:
2170

Title:
Signal Analysis

Catalog Description:
Introduces bandwidth, frequency response, noise, modulation, spectrum analysis and distortion and how they apply to design, troubleshooting and circuit operation of audio and radio frequency circuits.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
2

Requisites

Prerequisite and Corequisite
EET-1210 AC Electric Circuits.

Outcomes

Course Outcome(s):
Use electronic test equipment like distortion analyzers, network analyzers, spectrum analyzers, etc., to design, test and/or troubleshoot electronic equipment.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Use the spectrum analyzer to measure signals and their sidebands.
2. Calculate and measure signals using dB, dBm and dBV.
3. Analyze natural sources of interference.
4. Construct an electronic project that requires soldering and then test the project using instrumentation.
5. Measure fiber optic power and explain the operation of laser and Light Emitting diode sources and avalanche diodes and photo diodes as related to optical transmissions.
6. Explain losses that can occur in a fiber optic network.
7. Use a distortion analyzer to measure distortion in a periodic signal.
8. Measure rise and fall time.
9. Measure and explain sidebands and their effect on bandwidth.
10. Measure bandwidth requirements for common modulation schemes like amplitude modulation (AM), frequency modulation (FM), quadrature AM (QAM), (sine x)/x.
11. Explain bandwidth requirements from BODE plots.
12. Measure signal to noise ratio.
13. Explain Fourier Transforms at a basic level.

14. Discuss laws governing emission, for example, Federal Communications Commission (FCC) Part 47, FCC Part 15, and communication laws regarding connection to a telephone line and radiation from electronic equipment, respectively.

Course Outcome(s):

Analyze the sources of interference and its effects on analog and digital circuits.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Analyze man-made sources of interference.
2. Handling interference in a digital environment that produces errors: ignore errors, retransmit data pactet or correct errors using forward error correction.

Course Outcome(s):

Write a professional report with regard to the course project.

Essential Learning Outcome Mapping:

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

1. Create and import schematics that relate to the class project.
2. Create and import graphs that relate to the class project.
3. Use spelling and grammar checking features of the word processing software used to create report.
4. Demonstrate proficient report writing by using the formal lab report document provided by the instructor.

Methods of Evaluation:

a. Tests
b. Homework
c. Quizzes
d. Lab assignments
e. Projects (formal reports)

Course Content Outline:

a. Concepts
    i. AC Circuits theorems
    ii. Signal Distortion
    iii. Distortion analyzers
    iv. Spectrum analyzers
    v. Bandwidth
    vi. Frequency response
    vii. Fiber optic technology
    viii. Noise
        1. Minimizing effects in analog circuits
        2. Handling effects in digital circuits
            a. Ignoring bit errors
            b. Requesting retransmission
            c. Forward error correction
    ix. FCC rules and regulations
b. Skills
    i. Use unfamiliar test equipment like distortion analyzers, spectrum analyzers, dB meters, etc.
    ii. Use familiar test equipment in new ways like measuring rise and fall time, etc.
    iii. Using computer programs like software simulation, spread sheet, etc., to assist in design and troubleshooting

iv. Measure rise and fall time
v. Measure sidebands
vi. Measure bandwidth
vii. Measure signal to noise ratio
viii. Measure aspects of signals
ix. Soldering

c. Issues
i. Periodic and non-periodic signals
ii. Periodic non-sine signals decompose into a series of sine signals
iii. Relationship between fundamental and harmonics
iv. Distortion as a desired effect (modulation)
v. Distortion as an undesired effect
vi. Rate of change in an AC signal

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Resources

Wayne Tomasi. *Advanced Electronic Communications Systems.* 5th edition,. Prentice Hall, 2005.

Stallings. *Data and Computer Communication.* 10th edition,. Pearson, 2014.

Junyi Li, Xinz, Hou, Ragiv, Larola. *OFDMA Mobile Broadband Communications.* 1st edition,. Cambridge University, 2013.

Granburg. *Handbook of Digital Techniques for High Speed Design.* 1st edition,. Pearson, 2014.

Ziemer, Tranter. *Principals of Communications: Systems, Modulation and Noise.* 7st edition,. Wiley, 2013.

Pischella, Le Ruyet. *Digital Communications 2: Digital Modulation.* 1st edition,. Wiley, 2015.

Bandin. *Wireless Transceiver Architecture: Bridging RF and Digital Communications.* 1st edition,. Wiley, 2014.

Louis E. Frenzel. *Principles of Electronic Communication Systems*. Fourth. New York, NY: McGraw-Hill Education, 2016.

Resources Other

Oscilloscope/spectrum analyzer users manual.
Distortion analyzer users manual.
Internet research

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