EE-855 ERROR CONTROL CODING

Total Credits: 03

Lecture/Recitation/Discussion Hours: (3-0)

Course Objective:

To develop the mathematical and algorithmic foundations of the error detecting and error correcting codes used in modern communications systems.

Course Outline:

Fundamental Properties of Codes: introduction to error detection and correction, types of codes, minimum distance, vector algebra, abelian groups, binary fields. Block Coding Principles: generator matrix description, systematic codes, detection and correction bounds, Hamming, Reed-Muller and Golay codes. Decoding Block Codes: parity check matrix, syndrome calculation, cosets, standard array decoding, minimum weight theorems. Convolutional Codes: encoders, generator polynomials, constraint length, state diagrams, tree and trellis diagrams, distance measures. Decoding Convolutional Codes: Viterbi and sequential algorithms, syndrome decoders, soft-decision decoding, MAP decoding. Cyclic Codes: polynomial representation, extension field theory, generator theorems, systematic codes, generator circuits, syndrome calculation, error trapping, BCH and Reed-Solomon codes. Trellis Codes: bandwidth efficiency, performance analysis, differential encoding, rotational invariance. Turbo Codes: recursive systematic convolutional codes, parallel concatenation, interleaving, iterative decoding

Prerequisite:

Prior exposure to digital communications and linear algebra is helpful.

Required Textbook:

1 ***Error Control Coding,*** 2nd edition By Lin, Shu & Costello, Daniel J. ISBN: 0-13-042672-5

References Book:

1. Stephen B. Wicker, Error Control Systems for Digital Communication and Storage, Prentice Hall, 1995 (ISBN 0-13-200809-2).