COURSE ANNOUNCEMENT - Spring 2004

EE7000-2: Coding Theory (#1915)

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Motivation: Error-control codes have been traditionally used in computer memories and in very expensive communication systems such as deep space probes in order to protect digital data against errors that occur during storage and transmission. However, due to rapid advances in VLSI technology, today error-control codes find applications in a variety of consumer products such as compact discs, magnetic and optical storage devices, digital cellular and digital cordless phones, computer networks and a broad range of other communication systems. This course covers both the fundamentals of error-control coding as well as some of the applications of such systems. Decoding algorithms and performance analysis are integral parts of the course.

Topics:

1. Overview of digital communication and storage devices
2. Galois fields
   (a) Groups, fields, vector spaces
   (b) Galois fields, primitive polynomials
3. Polynomials over Galois fields
   (a) Euclid's algorithm
   (b) Minimal polynomials, conjugate elements
   (c) Factoring $X^n - 1$.
4. Linear block codes
   (a) Linear block codes
   (b) Standard array, Syndrome decoding
   (c) Weight distribution of block codes
5. Cyclic codes
   (a) Theory of Cyclic codes
   (b) Shift register encoders and decoders

   (c) Shortened cyclic codes and cyclic redundancy check

6. BCH and Reed-Solomon codes

   (a) Theory of BCH and RS codes
   (b) Properties of RS codes
   (c) MOdified RS codes

7. Decoding BCH and Reed-Solomon codes

8. Convolutional codes

   (a) Structure of encoders
   (b) Trellis and state diagrams
   (c) Viterbi decoding

9. Turbo codes

Applications will be discussed throughout the course.

Background: Familiarity with linear algebra and probability. If you have any questions regarding this course, please contact the instructor.

Text: *ERROR CONTROL SYSTEMS for Digital Communication and Storage*, Stephen B. Wicker, Prentice-Hall, Inc.
As well as journal papers.