

Error control coding: An introduction to linear block codes

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Lecture #10: Applications of Linear Block Codes



Outline of the lecture

- Historical timeline

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- ISBN numbers

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- BookLand Bar Code



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- Coding for Wireless Communications



Historical Timeline

1948	Shannon founded information theory, discovery of Golay codes
1950	Single error correcting Hamming codes
1955	Invention of convolutional codes by Elias.
1960	Reed-Solomon Codes
1960	LDPC codes (Gallager)
1961-63	Sequential decoding of convolutional codes (Wozencraft, Fano)
1967	ML decoding of convolutional codes (Viterbi algorithm)
1968-69	Berlekemp-Massey algorithm to decode BCH and RS codes
1968	Convolutional codes for the Pioneer space vehicle
1974	Convolutional codes for the Helios space vehicle
1976-82	Coded modulation (Ungerboeck codes)
1977	Concatenated codes for Voyager space vehicle
1993	Turbo codes
1995	Graph based codes



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- This code can detect transposition error.



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- When all the 10-digit numbers are used, a new prefix (979) will be started.



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- It can be verified if the UPC is valid by observing the sum, s in Step 4. The sum, s , should be $s = 0 \pmod{10}$.



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 - Product code, consisting of five digits.
 - Check digit, a single checksum digit. The check digit is computed modulo 10, where the weights in the checksum calculation alternate 1 and 3.



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 - fingerprints, scratches, or dust particles from handling.



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- Unfortunately, the compact disc was basically a bursterror channel and the convolutional code failed to correct bursts.



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 - If the error burst exceeds the capability of the interpolator, the decoder blanks out, or mutes the system for the duration of the unreliable samples.



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The resulting performance of the CIRC scheme.

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- The compact disc can endure 8 mm holes punched through the disc without noticeable effect.



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Coding for Deep Space Applications

- The CCSDS (The Consultative Committee for Space Data Systems) published an "experimental specification" for near-earth and deep space communication in 2007.

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- In 2011 the LDPC codes were adopted as "recommended standard".

S. No	Blocksize	Information Word	Code Rate
1	8176	7154	7/8
2	1280	1024	4/5
3	1536	1024	2/3
4	2048	1024	1/2
5	5120	4096	4/5
6	6144	4096	2/3
7	8192	4096	1/2
8	20480	16384	4/5
9	24576	16384	2/3
10	32768	16384	1/2

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- 10 GBASE-T contains a special class of LDPC codes (so-called Reed-Solomon code-based LDPC codes or RS-LDPC codes). A Reed-Solomon code is used to define the generator matrix of the LDPC code. The LDPC code construction method guarantees that no cycles of length four are contained within the Tanner graph.



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