



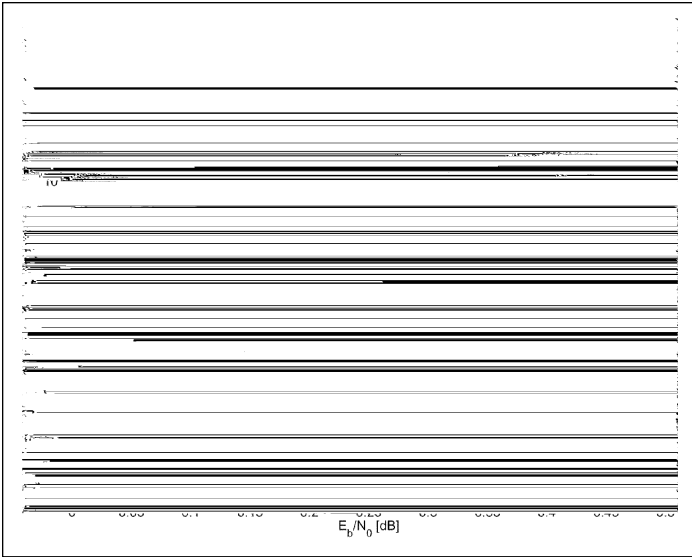
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$$\chi(\epsilon p) = \epsilon^{<\epsilon^>}$$

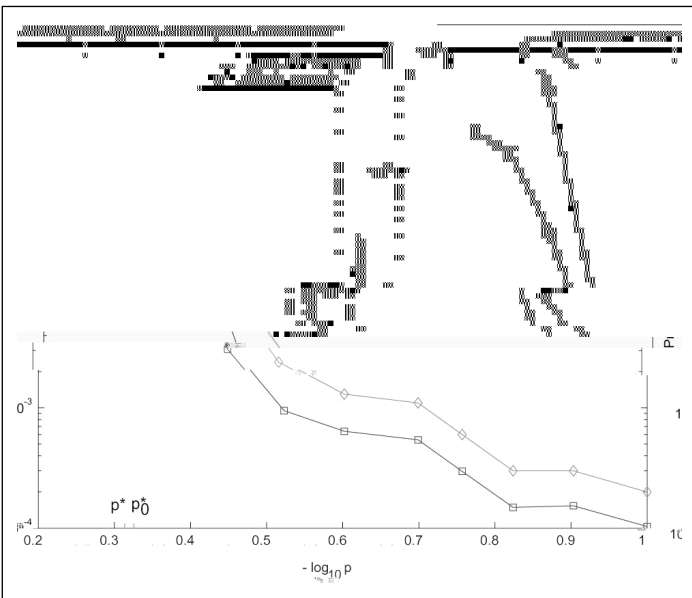
Proof: $\epsilon^{<\epsilon^>}$



Performance of LDPC Code on a BEC

$$\chi(\epsilon, p) = \frac{1}{\epsilon} \left(\frac{\epsilon}{p} \right)$$

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 This equation relates the error rate ϵ to the erasure probability p for a BEC. It shows that the error rate is inversely proportional to the erasure probability.



Performance of Rate R Code on a BEC

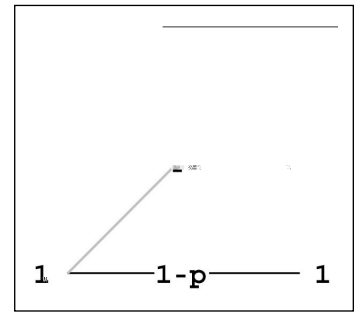


Performance of Code on a BEC

The plot shows the performance of a code on a BEC. The x-axis is labeled E_b/N_0 [dB] and ranges from 0 to 0.5. The y-axis represents the error rate. The plot shows a sharp drop in error rate as E_b/N_0 increases, indicating the threshold behavior of the code.

3. Beyond SBIC's.

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Performance of Code on a BEC

The plot shows the performance of a code on a BEC. The x-axis is labeled E_b/N_0 [dB] and ranges from 0 to 0.5. The y-axis represents the error rate. The plot shows a sharp drop in error rate as E_b/N_0 increases, indicating the threshold behavior of the code.

4. Nonsymmetric Channels.

The plot shows the performance of a code on a BEC. The x-axis is labeled E_b/N_0 [dB] and ranges from 0 to 0.5. The y-axis represents the error rate. The plot shows a sharp drop in error rate as E_b/N_0 increases, indicating the threshold behavior of the code.

Let \mathcal{C}_1 and \mathcal{C}_2 be codes with parameters (n, k_1, d_1) and (n, k_2, d_2) respectively. Let $\mathcal{C} = \mathcal{C}_1 \oplus \mathcal{C}_2$ be the direct sum of \mathcal{C}_1 and \mathcal{C}_2 . Then \mathcal{C} is a code with parameters $(2n, k_1 + k_2, \min\{d_1, d_2\})$.

Proof: Let $\mathbf{c} = (\mathbf{c}_1, \mathbf{c}_2) \in \mathcal{C}$, where $\mathbf{c}_1 \in \mathcal{C}_1$ and $\mathbf{c}_2 \in \mathcal{C}_2$. Then \mathbf{c} is a vector of length $2n$. The dimension of \mathcal{C} is $k_1 + k_2$ because the vectors in \mathcal{C}_1 and \mathcal{C}_2 are linearly independent. The minimum distance of \mathcal{C} is $\min\{d_1, d_2\}$ because if $\mathbf{c}_1 \neq \mathbf{0}$ and $\mathbf{c}_2 = \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) = d_1$. Similarly, if $\mathbf{c}_1 = \mathbf{0}$ and $\mathbf{c}_2 \neq \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) = d_2$. If both $\mathbf{c}_1 \neq \mathbf{0}$ and $\mathbf{c}_2 \neq \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) \geq \min\{d_1, d_2\}$.

Let \mathcal{C}_1 and \mathcal{C}_2 be codes with parameters (n, k_1, d_1) and (n, k_2, d_2) respectively. Let $\mathcal{C} = \mathcal{C}_1 \oplus \mathcal{C}_2$ be the direct sum of \mathcal{C}_1 and \mathcal{C}_2 . Then \mathcal{C} is a code with parameters $(2n, k_1 + k_2, \min\{d_1, d_2\})$. Let $\mathbf{c} = (\mathbf{c}_1, \mathbf{c}_2) \in \mathcal{C}$. Then $\mathbf{c}_1 \in \mathcal{C}_1$ and $\mathbf{c}_2 \in \mathcal{C}_2$. The minimum distance of \mathcal{C} is $\min\{d_1, d_2\}$ because if $\mathbf{c}_1 \neq \mathbf{0}$ and $\mathbf{c}_2 = \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) = d_1$. Similarly, if $\mathbf{c}_1 = \mathbf{0}$ and $\mathbf{c}_2 \neq \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) = d_2$. If both $\mathbf{c}_1 \neq \mathbf{0}$ and $\mathbf{c}_2 \neq \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) \geq \min\{d_1, d_2\}$.

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5. An Old Theorem of Gallager.

Let \mathcal{C}_1 and \mathcal{C}_2 be codes with parameters (n, k_1, d_1) and (n, k_2, d_2) respectively. Let $\mathcal{C} = \mathcal{C}_1 \oplus \mathcal{C}_2$ be the direct sum of \mathcal{C}_1 and \mathcal{C}_2 . Then \mathcal{C} is a code with parameters $(2n, k_1 + k_2, \min\{d_1, d_2\})$. Let $\mathbf{c} = (\mathbf{c}_1, \mathbf{c}_2) \in \mathcal{C}$. Then $\mathbf{c}_1 \in \mathcal{C}_1$ and $\mathbf{c}_2 \in \mathcal{C}_2$. The minimum distance of \mathcal{C} is $\min\{d_1, d_2\}$ because if $\mathbf{c}_1 \neq \mathbf{0}$ and $\mathbf{c}_2 = \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) = d_1$. Similarly, if $\mathbf{c}_1 = \mathbf{0}$ and $\mathbf{c}_2 \neq \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) = d_2$. If both $\mathbf{c}_1 \neq \mathbf{0}$ and $\mathbf{c}_2 \neq \mathbf{0}$, then $d(\mathbf{c}, \mathbf{0}) \geq \min\{d_1, d_2\}$.

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March, 2001.

Claude Elwood Shannon 1916-2001. *Shannon's Theory of Communication*
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Shannon's juggling theorem

$L \leq M \leq C \log_2 L$
 $M \leq C \log_2 L$

$B = \{y \in \mathbb{R}^n \mid \exists x \in \mathbb{R}^n, Ax = y\}$
 $\Leftrightarrow \exists x \in \mathbb{R}^n, \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$
 $\Leftrightarrow \begin{cases} x_1 = y_1 \\ x_2 = y_2 \\ 0 = y_3 \end{cases}$
 $\Rightarrow B = \{y \in \mathbb{R}^n \mid y_3 = 0\}$
 $\Rightarrow B = \text{Ann}(M)$

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Software Radio Technologies: Selected Readings,

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Voice Compression and Communications,

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Introduction to 3G Mobile Communications,

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Wireless Communication Technologies: New Multimedia Systems,

Nonuniform Sampling: Theory and Practice,

Numbers, Information and Complexity,

The Mobile Communications Handbook, 2nd Ed.,

The Telecommunications Handbook,

Hargrave's Communications Dictionary,

Intelligent Signal Processing,

A Field Guide to Dynamical Recurrent Networks,

Cable Modems: Technologies and Applications,

Wireless Video Communications: Second- and Third-Generation Systems and Beyond,

WCDMA for UMTS: Radio Access for Third Generation Mobile Communications, Revised Edition,

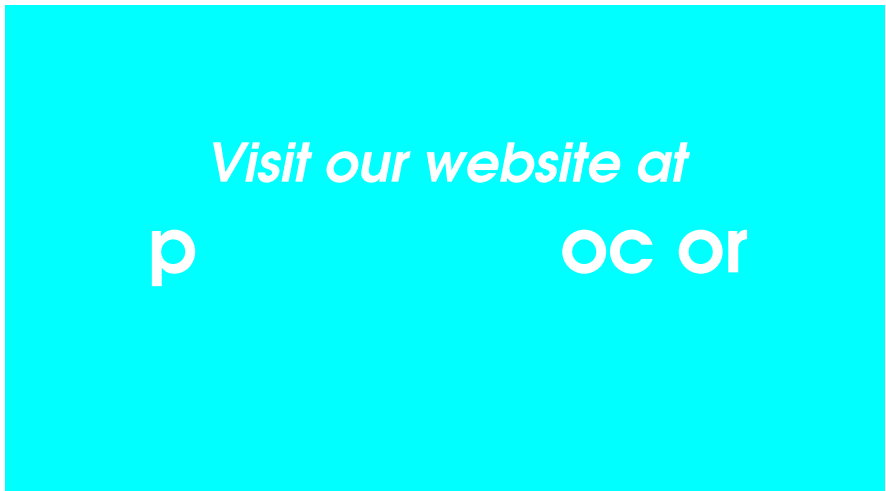
UMTS Mobile Communications for the Future,

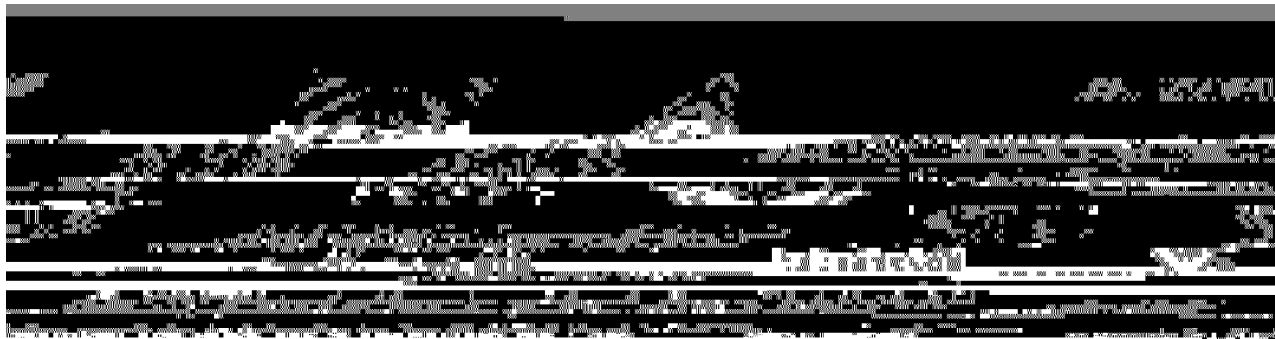
CDMA: Access and Switching: For Terrestrial and Satellite Networks

Wireless Video Communications: Second to Third Generation and Beyond,

Principle of Mobile Communication, 2nd Ed.,

Turbo Codes: Principles and Applications,





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