

* EXAMPLE OF CONV. CODE

OUTPUT:

sample output of
a convolutional code.

consider the bit sequence:

$1 \quad 0 \quad 1 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 1$
 $x(0) \quad x(1) \quad x(2) \quad x(3) \quad x(4) \quad x(5) \quad x(6) \quad x(7) \quad x(8) \quad x(9)$

Binary Field Addition

$$C_0(j) = x(j) + x(j-2)$$

$$C_0(0) = x(0) + x(-2)$$

code bit 0

$$= 1 + 0 = 1$$

at time $j=0$.

$$x(-1) = 0$$

code bit 1

at time $j=0$.

$$x(-2) = 0$$

$$C_1(0) = x(0) + x(-1) + x(-2)$$

$$= 1 + 0 + 0$$

$$= 1$$

$$C_0(1) = x(1) + x(-1)$$

$$= 0 + 0 = 0$$

$$C_1(1) = x(1) + x(0) + x(-1)$$

$$= 0 + 1 + 0$$

$$= 1$$

$$C_0(2) = x(2) + x(0)$$

$$= 1 + 1 = 0$$

$$\begin{aligned}
 C_1(2) &= x(2) + x(1) + x(0) \\
 &= 1 + 0 + 1 \\
 &= 0
 \end{aligned}$$

Codebit 1
at time $j=2$

Similarly, repeat for
other time instants

Resulting
code bits

$$\begin{array}{lcl}
 C_0 & = & \underline{1 \ 0 \ 0 \ 1 \ 1 \ 1 \ 1 \ 0 \ 0 \ 1} \\
 C_1 & = & \underline{1 \ 1 \ 0 \ 0 \ 0 \ 1 \ 1 \ 1 \ 0 \ 0}
 \end{array}$$

10 bits

10 bits

information bits = 10

code bits = 20

$$\boxed{\text{Rate} = \frac{10}{20} = \frac{1}{2}}$$

Convolutional Code:

Why convolutional code?

$$\begin{aligned} C_0(j) &= x(j) + x(j-2) \\ &= \underbrace{1}_{h_0(0)} \cdot x(j) + \underbrace{0}_{h_0(1)} \cdot x(j-1) \end{aligned}$$

$$= \sum_{k=0}^2 h_0(k) x(j-k)$$

$\uparrow$ $h_0(2)$
Convolution

$$h_0(0) = 1 \quad h_0(1) = 0$$

$$h_0(2) = 1$$

Filter h for convolution

$$\begin{aligned}
 c_1(j) &= x(j) + x(j-1) \\
 &\quad + x(j-2) \\
 &= \overset{h_1(0)}{1} \cdot x(j) + \overset{h_1(1)}{1} \cdot x(j-1) \\
 &\quad + \overset{h_1(2)}{1} \cdot x(j-2) \\
 &= \sum_{k=0}^2 h_1(k) x(j-k)
 \end{aligned}$$

Convolution

$$h_1(0) = h_1(1) = h_1(2) = 1$$

Filter for codebit stream 1

Code is generated from a _____
convolution operation.

input information
Bit Stream
with suitable filter

Hence, termed as
a convolutional code.