**LDPC DECODING**

**STEPS FOR EXECUTING LDPC DECODING USING SISO (SOFT INPUT SOFT OUTPUT) MINSUM ITERATIVE MESSAGE PASSING ALORITHM:**

1. For initialization, take received code word (noise added with all message bit 0) of length 1X7, LLR =

[0.4281 1.5147 -0.4577 0.3089 -0.6264 1.9481 -0.0228]

2. For 1st iteration, assign LLR values to r\_new, r\_new =

[0.4281 1.5147 -0.4577 0.3089 -0.6264 1.9481 -0.0228]

3. Let's take sparse base matrix (parity check matrix) of dimension 4X7, Base\_Mat =

4. Multiply r\_new with the base matrix element-wise, L =

0.4281 1.5147 -0.4577 0 -0.6264 0 0

0 1.5147 -0.4577 0.3089 0 1.9481 0

0.4281 1.5147 0 0.3089 0 0 -0.0228

0.4281 0 -0.4577 0 -0.6264 1.9481 -0.0228

5. Observe the sign (Sgn) of each element row-wise, Sgn =

1 1 -1 0 -1 0 0

0 1 -1 1 0 1 0

1 1 0 1 0 0 -1

1 0 -1 0 -1 1 -1

6. In minsum decoder two minimum (min1, min2) absolute value of all non-zero entries is need to be taken in each row, so convert all zeros into any higher value (let's take it 100), L =

0.4281 1.5147 -0.4577 100.0000 -0.6264 100.0000 100.0000

100.0000 1.5147 -0.4577 0.3089 100.0000 1.9481 100.0000

0.4281 1.5147 100.0000 0.3089 100.0000 100.0000 -0.0228

0.4281 100.0000 -0.4577 100.0000 -0.6264 1.9481 -0.0228

7. Row Operation: For each row,

i. min1: minimum absolute value of all nonzero entries in row and its position.

Lmin1 = 0.4281 0.3089 -0.0228 -0.0228

Pos1 = 1 4 7 7

ii. min2: next higher absolute value and its position.

Lmin2 = -0.4577 -0.4577 0.3089 0.4281

Pos2 = 3 3 4 1

iii. Set magnitude of all values (except min1) = min1

iv. Set magnitude of min1 value = min2, abs(L) =

0.4577 0.4281 0.4281 100.0000 0.4281 100.0000 100.0000

100.0000 0.3089 0.3089 0.4577 100.0000 0.3089 100.0000

0.0228 0.0228 100.0000 0.0228 100.0000 100.0000 0.3089

0.0228 100.0000 0.0228 100.0000 0.0228 0.0228 0.4281

v. Parity (S)= Product of signs of entries in row.

S = 1 -1 -1 -1

vi. New sign of an entry = Parity(S).\*old sign (sgn).\*abs (L), L =

0.4577 0.4281 -0.4281 0 -0.4281 0 0

0 -0.3089 0.3089 -0.4577 0 -0.3089 0

-0.0228 -0.0228 0 -0.0228 0 0 0.3089

-0.0228 0 0.0228 0 0.0228 -0.0228 0.4281

8. Column Operation: For each column,

i. New LLR values, sum (LLR) = initially received code (r\_new) word + sum of all entries column-wise, LLR =

0.8402 1.6111 -0.5541 -0.1716 -1.0317 1.6164 0.7142

9. Repeat above steps for more iteration.

10. Thresholding of LLR values =

1 1 0 0 0 1 1