Analysis of the performance of min sum decode algorithm in Gaussian channel for random matrices

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Notations

- n - Block size.
- Eb/No - Input SNR in db to maintain input BER between 10^{-2} to 10^{-3}.
- BER(IN) - Input bit error rate.
- BER(OUT) - Output bit error rate.
- CDB - Number of correctly decoded blocks.
- Itr - Average number of iterations per block.

Min Sum Decode (Rate=0.75)

n	BER(In)	Eb/No(db)	BER(OUT)	CDB	Itr(/150)
4096	$1.0x10^{-2}$	5.5	0	100	2
	$4.8x10^{-3}$	6.5	0	100	1
	$1.8x10^{-3}$	7.5	0	100	1
8192	$1.0x10^{-2}$	5.5	0	100	2
	$4.8x10^{-3}$	6.5	0	100	1
	$1.8x10^{-3}$	7.5	0	100	1
12288	$1.0x10^{-2}$	5.5	0	100	2
	$4.8x10^{-3}$	6.5	0	100	1
	$1.8x10^{-3}$	7.5	0	100	1
16384	$1.0x10^{-2}$	5.5	0	100	2
	$4.8x10^{-3}$	6.5	0	100	1
	$1.8x10^{-3}$	7.5	0	100	1

Min Sum Decode (Rate=0.8)

n	BER(In)	Eb/No(db)	BER	CDB	Itr(/150)
4096	$0.8x10^{-2}$	5.5	0	100	2
	$3.8x10^{-3}$	6.5	0	100	1
	$1.5x10^{-3}$	7.5	0	100	1
8192	$0.8x10^{-2}$	5.5	0	100	2
	$3.8x10^{-3}$	6.5	0	100	1
	$1.5x10^{-3}$	7.5	0	100	1
12288	$0.8x10^{-2}$	5.5	0	100	2
	$3.8x10^{-3}$	6.5	0	100	1
	$1.5x10^{-3}$	7.5	0	100	1
16384	$0.8x10^{-2}$	5.5	0	100	2
	$3.8x10^{-3}$	6.5	0	100	1
	$1.5x10^{-3}$	7.5	0	100	1

Min Sum Decode (Rate=0.85)

n	BER(IN)	Eb/No(db)	BER	CDB	Itr(/150)
4096	$1.0x10^{-2}$	5	0	100	3
	$4.5x10^{-3}$	6	0	100	2
	$1.7x10^{-3}$	7	0	100	1
8192	$1.0x10^{-2}$	5	0	100	3
	$4.5x10^{-3}$	6	0	100	2
	$1.7x10^{-3}$	7	0	100	1
12288	$1.0x10^{-2}$	5	0	100	3
	$4.5x10^{-3}$	6	0	100	2
	$1.7x10^{-3}$	7	0	100	1
16384	$1.0x10^{-2}$	5	0	100	3
	$4.5x10^{-3}$	6	0	100	2
	$1.7x10^{-3}$	7	0	100	1

Min Sum Decode (Rate=0.9)

n	BER(IN)	Eb/No(db)	BER	CDB	Itr(/150)
4096	$0.9x10^{-2}$	5	0	100	3
	$3.6x10^{-3}$	6	0	100	2
	$1.3x10^{-3}$	7	0	100	1
8192	$0.9x10^{-2}$	5	0	100	3
	$3.6x10^{-3}$	6	0	100	2
	$1.3x10^{-3}$	7	0	100	1
12288	$0.9x10^{-2}$	5	0	100	4
	$3.6x10^{-3}$	6	0	100	2
	$1.3x10^{-3}$	7	0	100	1
16384	$0.9x10^{-2}$	5	0	100	4
	$3.6x10^{-3}$	6	0	100	2
	$1.3x10^{-3}$	7	0	100	1

Min Sum Decode (Rate=0.95)

n	Eb/No(db)	BER	CDB	Itr(/150)
4096	-	-	-	-
8192	-	-	-	-
12288	4.5 5.5 6.5	0.0075 0 0	0 100 100	- 4 2
16384	4.5 5.5 6.5	0.0072 0 0	0 100 100	- 4 2

- n = 4096 and 8192 cycle free random matrix was not able to generate.

First error till 10 million blocks

n$\simeq$	BER(In)$\simeq$	R=0.75	R=0.8
4K	$1.0x10^{-2}$	$1.2799x10^{4}$	$2.0754x10^{4}$
	$0.5x10^{-3}$	$5.53727x10^{5}$	$1.72781x10^{5}$
	$1.0x10^{-3}$	-	$6.24436x10^{5}$
8K	$1.0x10^{-2}$	$1.92476x10^{5}$	$8.3898x10^{4}$
	$0.5x10^{-3}$	$3.21027x10^{5}$	$4.6092x10^{4}$
	$1.0x10^{-3}$	-	-
12K	$1.0x10^{-2}$	$2.20022x10^{5}$	$1.57371x10^{5}$
	$0.5x10^{-3}$	$2.17452x10^{5}$	$9.0158x10^{4}$
	$1.0x10^{-3}$	-	-

First error till 10 million blocks

n≃	BER(In)≃	R=0.85	R=0.9	R=0.95
4K	$1.0x10^{-2}$	$3.39x10^{2}$	$1.259x10^{3}$	NA
	$0.5x10^{-3}$	$6.6700x10^{4}$	$1.65511x10^{5}$	NA
	$1.0x10^{-3}$	$345503x10^{5}$	$1.19008x10^{5}$	NA
8K	$1.0x10^{-2}$	$5.193x10^{3}$	$5.947x10^{3}$	NA
	$0.5x10^{-3}$	$3.7952x10^{4}$	$1.1389x10^{4}$	NA
	$1.0x10^{-3}$	-	-	NA
12K	$1.0x10^{-2}$	$1.2894x10^{4}$	$1.2626x10^{4}$	1.1
	$0.5x10^{-3}$	$1.56487x10^{5}$	$5.4866x10^{4}$	$1.034x10^{4}$
	$1.0x10^{-3}$			$1.4759x10^{4}$