NGCN302_experiment12_v241202a

2024년 11월 28일 목요일 오전 10:38

NGCN30... NGCN30...

Experiment 12:

DBPSK and Differential Coherent Detection of Encoded BPSK

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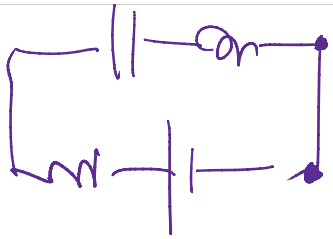
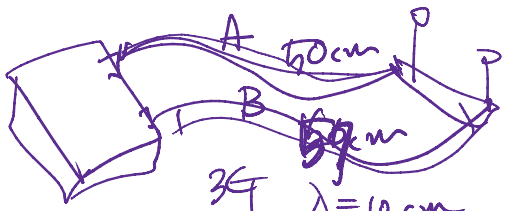
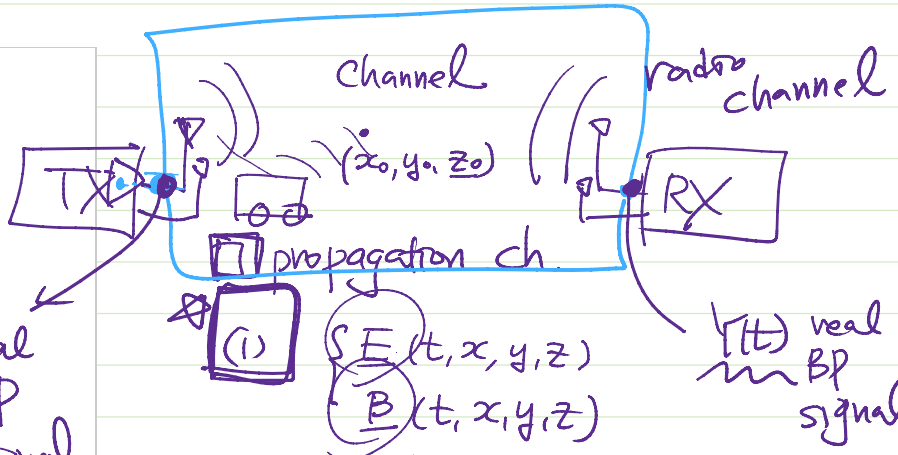
Communication and Intelligent Systems Lab. (CISL)

Outline







DC X(t) real BP signal

Y(t) real BP signal

$$Y(t) = X(t) * h(t) \quad (*)$$

LTI

$$= \int_{-\infty}^{\infty} h(t,\tau) X(\tau) d\tau \quad (\circ)$$

1. DBPSK
2. Differentially Coherent Detection
3. Today's Experiment
4. About Report

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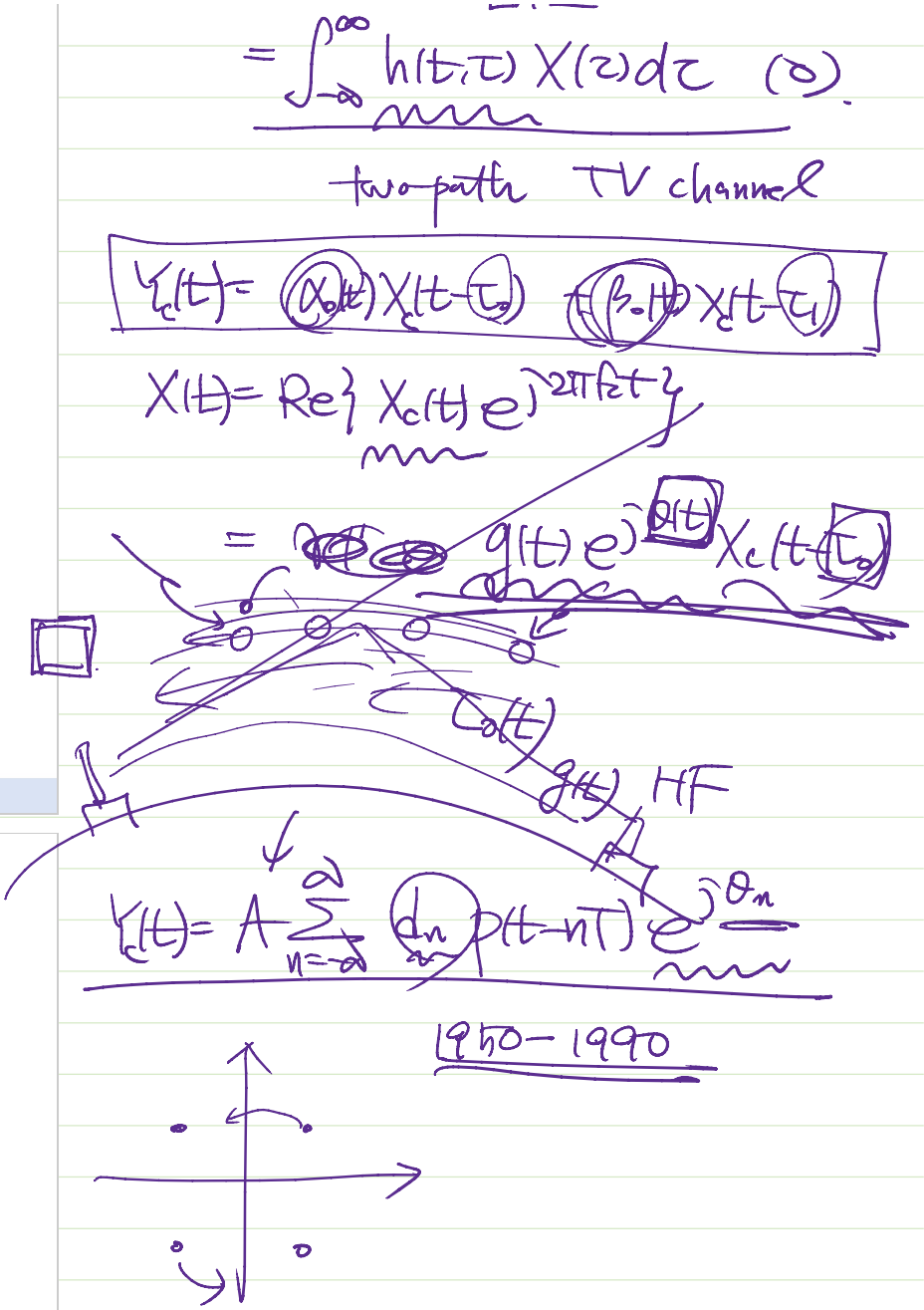

3. Today's Experiment

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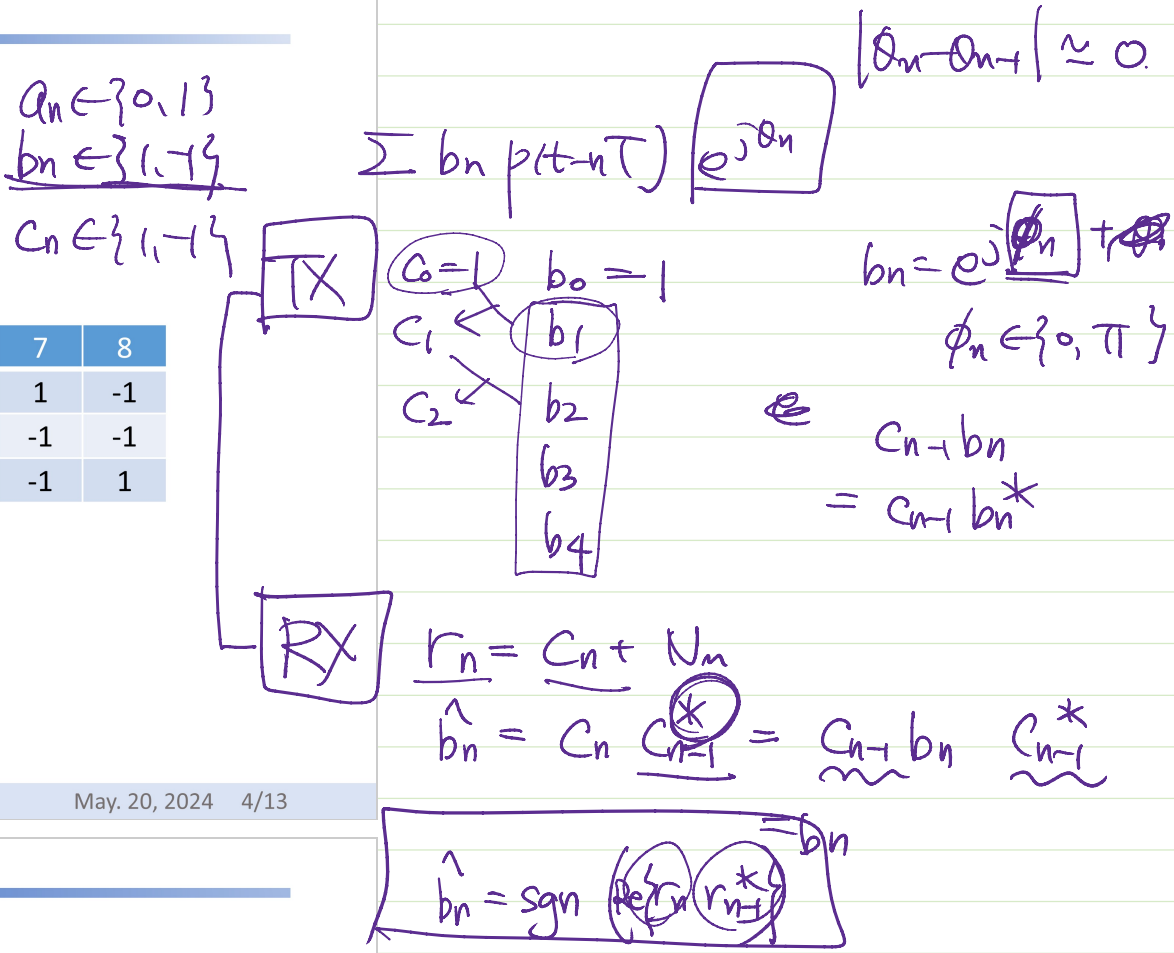
DBPSK

- DBPSK : Differentially Encoded BPSK
  - Symbol의 "phase difference"에 정보를 싣는다.
  - BPSK Symbol : $b_n \in \{-1, 1\}$
  - DPSK Symbol : $c_0 = 1, c_n = c_{n-1} b_n$

n	0	1	2	3	4	5	6	7	8
b_n		1	-1	-1	1	-1	1	1	-1
c_{n-1}		1	1	-1	1	1	-1	-1	-1
c_n	1	1	-1	1	1	-1	-1	-1	1

  - $b_n = 1$이면 $c_n = c_{n-1}$ (phase difference : 0)
  - $b_n = -1$이면 $c_n = -c_{n-1}$ (phase difference = π)



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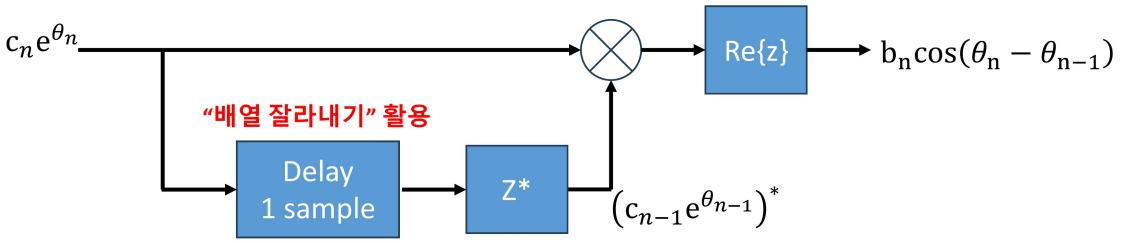
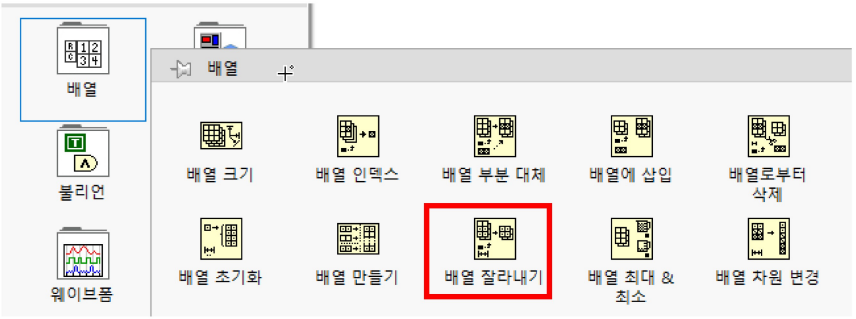
Differentially Coherent Detection

- Downsampling 후의 신호는 Carrier Frequency Offset에 의해 rotation 발생.
  - Received symbol : $c_0 e^{\theta_0}$, $c_1 e^{\theta_1}$, $c_2 e^{\theta_2}$, ⋯
- $|\theta_n - \theta_{n-1}|$ 이 충분히 작으면
  - $\mathrm{Re}\{(c_n e^{\theta_n})(c_{n-1} e^{\theta_{n-1}})^*\} = \mathrm{Re}\{c_n c_{n-1} e^{\theta_n - \theta_{n-1}}\} = \mathrm{Re}\{b_n e^{\theta_n - \theta_{n-1}}\}$
    $= b_n \cos(\theta_n - \theta_{n-1}) \approx b_n$



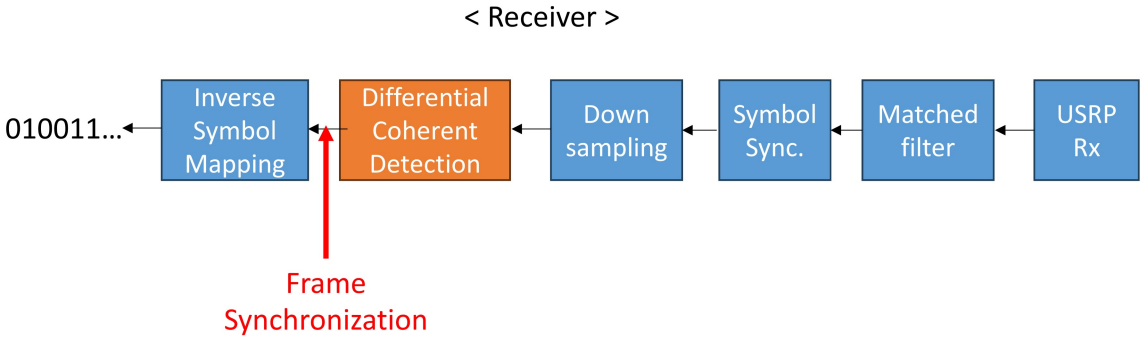
Differentially Coherent Detection

- 배열 잘라내기
  - ➢ 입력 : 배열, 시작 index, 길이
    - **길이 입력이 없으면 시작 index부터 배열 끝까지 잘라냄.**
  - ➢ 출력 : 시작 index부터 입력한 길이만큼 잘라낸 배열



Differentially Coherent Detection

- Diff. coherent Detection 위치



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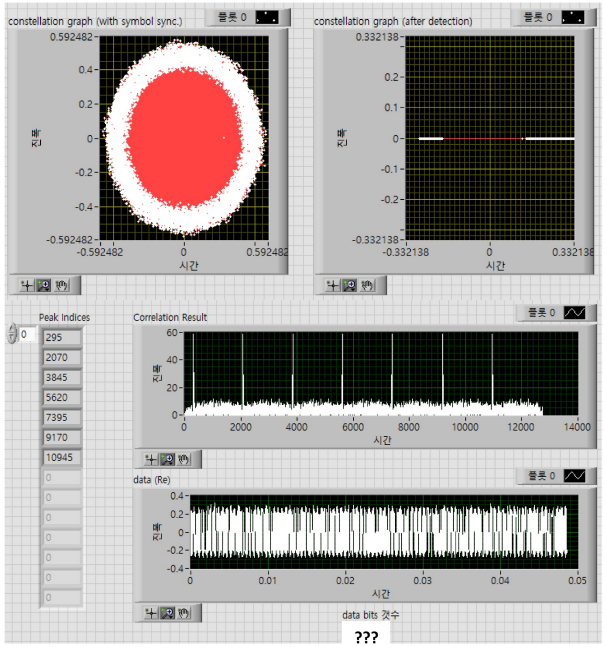
Today's Experiment

- Frame synchronization 수행.
  - ➢ 송신 신호 정보 **(DBPSK modulated)**
    - IQ rate : 500,000 samples/s [500 KS/s]
    - Filter : Root Raised Cosine
    - Roll-off factor : 0.35
    - Filter length : 11
    - Oversampling factor : 16
    - Center frequency : 2.3765 GHz
    - Training Sequence : **m-sequence with order 8**
  - ➢ Differentially Coherent Detection 수행
    - Coherent Detection 전후의 신호의 IQ 그래프[1]를 출력
    - 이 신호를 사용하여 Frame Sync. 수행, Frame의 시작점[2]이 어디인지 판단해 볼 것.
    - Frame에서 data 부분을 추출하고 길이는 몇 bit인지[3] 알아보자
    - Diff. Coherent Detection 수행 부분은 모듈화[4]할 것.

Today's Experiment

- 결과 예시



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About Report

- Due:
- Must be included :
  - ➢ Differentially Coherent Detection 수행 결과
    - ▪ 전체 코드(block diagram)[1], 프런트 패널[2]
      - 반드시 Diff. Coherent detection 수행 부분을 모듈화[3]
      - 만들어진 subvi의 block diagram[4]도 첨부
    - ▪ Diff. Coherent Detection 전후의 신호를 IQ plain에 그린 결과[5]
    - ▪ Diff. Coherent Detection 후의 신호와 training seq.의 상호 상관 결과 (**magnitude**)[6]
    - ▪ 상호 상관 결과에서 peak의 index[7], 이를 통해 판단한 frame의 시작점 위치[8]
    - ▪ Data에 해당하는 부분을 잘라낸 결과 (**Re**)[9], data bits의 개수[10]
  - ➢ Discussion
    - ▪ DBPSK vs. BPSK performance?? (ex. BER vs. Eb/N0) [11]
- jhchoi0226@postech.ac.kr로 제출