

Navigation Principle Homework-5

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1 Task Goal

- Outline approach to generate GNSS codes, e.g., GPS L1C/A, L2C(CM or CL), L5 (I or Q), B1I, B2a(data or pilot), B3I.
- Generate two PRN code samples and compute their cross-correlations and each of their own autocorrelation.

2 L1C/A-Outline

- We can define 0,1 in prn code as 1 and -1 in our MATLAB code respectively. So that, the xor opt can be transfered into multiple opt in MATLAB code.
- Then, via the math method below, we can generate G1 and G2 series

$$C/A_i(t) = A(t) \oplus B(t-D_i)$$

where:

C/A_i is the code with PRN number i .

A is the output of the first LFSR whose generator polynomial is $x \rightarrow x^{10} + x^3 + 1$, and initial state is 1111111111₂.

B is the output of the second LFSR whose generator polynomial is $x \rightarrow x^{10} + x^9 + x^8 + x^6 + x^3 + x^2 + 1$ and initial state is also 1111111111₂.

D_i is a delay (by an integer number of periods) specific to each PRN number i ; it is designated in the GPS interface specification.^[4]

\oplus is exclusive or.

- Finally, shift the G2 series according to the Code Delay Chips Table. Then xor G2 and G1 to get our final code

3 Correlation

First, we need to generate two different PRN codes.

Via calculation in code, The cross-correlations of the two PRN codes and one PRN code's Correlation are shown in the image in page2.

As we can see, The outcome of Correlation agrees with the table, while outcome of cross-correlations not agrees with the table, since different PRN codes are orthogonal, so there doesn't exist 1 condition in cross-correlations outcome.

```
#####  
The outcomes of one prn code autocorrelation are list below(\1023):  
Num of -1: 782  
Num of -65:120  
Num of 63: 120  
Num of 1024: 1  
#####  
The outcomes of two prn codes cross-correlation are list below(\1023):  
Num of -1: 751  
Num of -65:128  
Num of 63: 144  
Num of 1024: 0
```