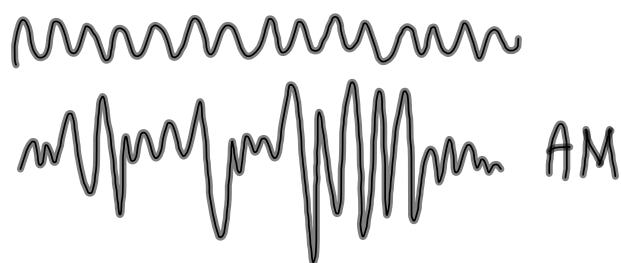


C/A code onto L1 32 versions 31-1
 1023 binary values PRN 1-32
 period 1ms

20 codes : 1 navigation bit
 nav. bit rate 50 hz

Nov 4-9:26 AM

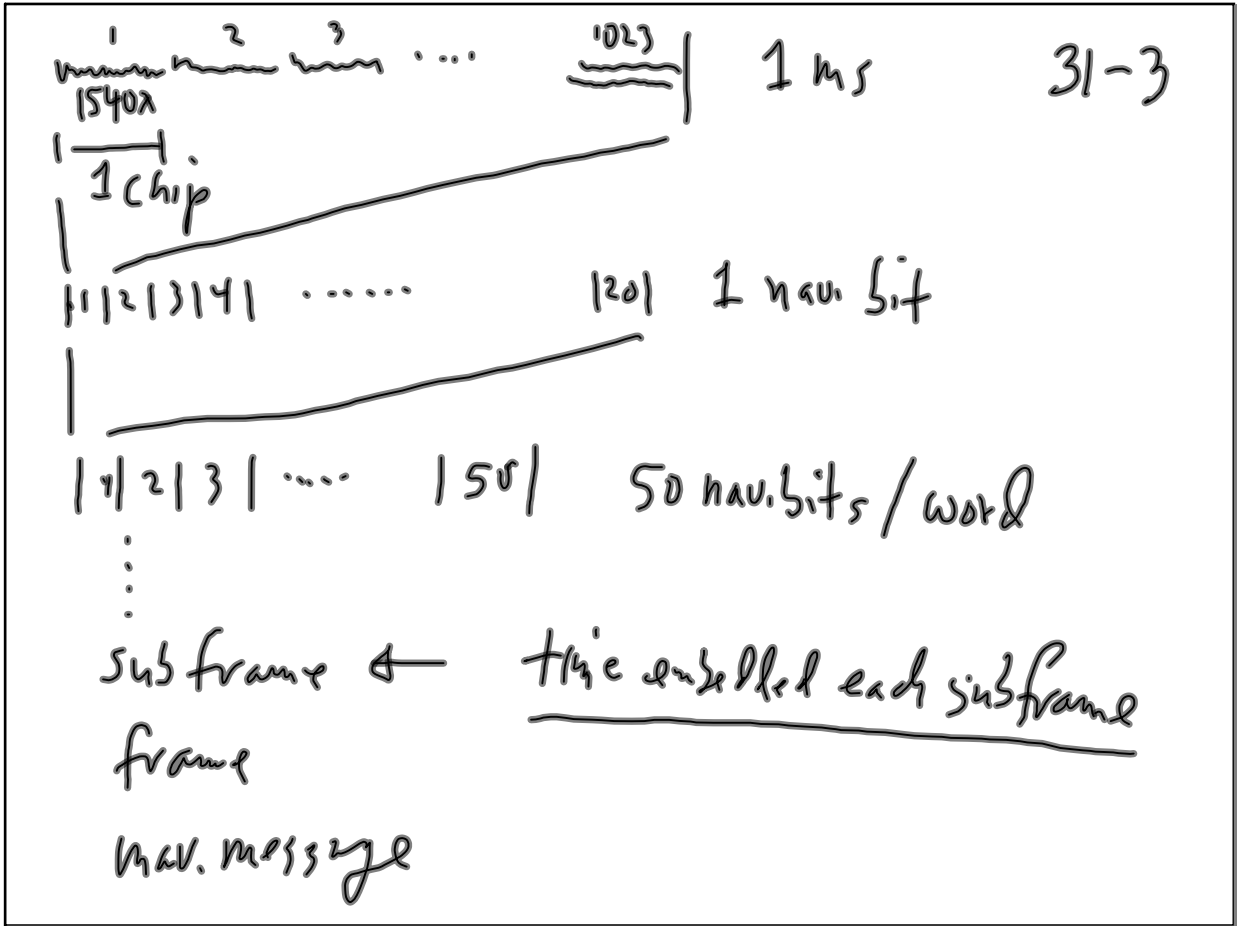
 AM

 FM

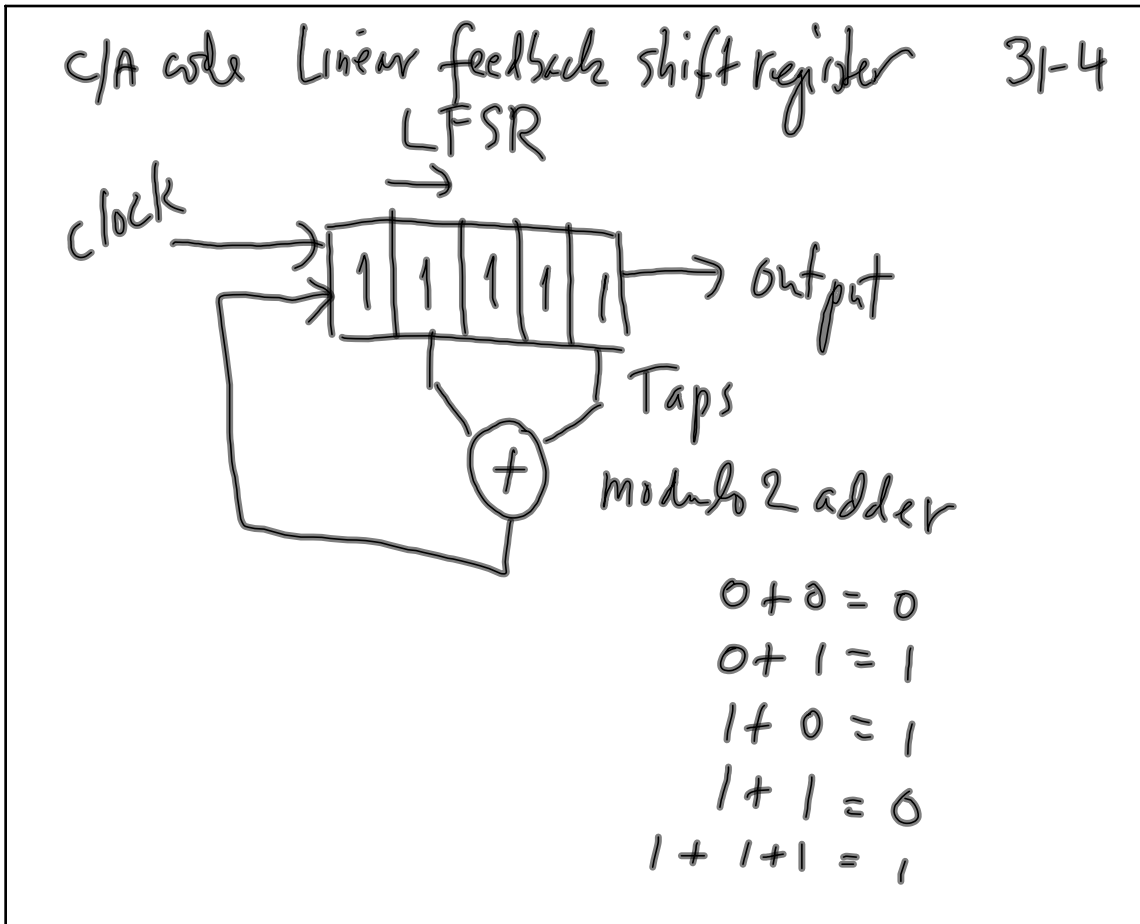
 PM ✓

 Binary Phase Shift Keying BPSK

Nov 4-9:27 AM



Nov 4-9:27 AM

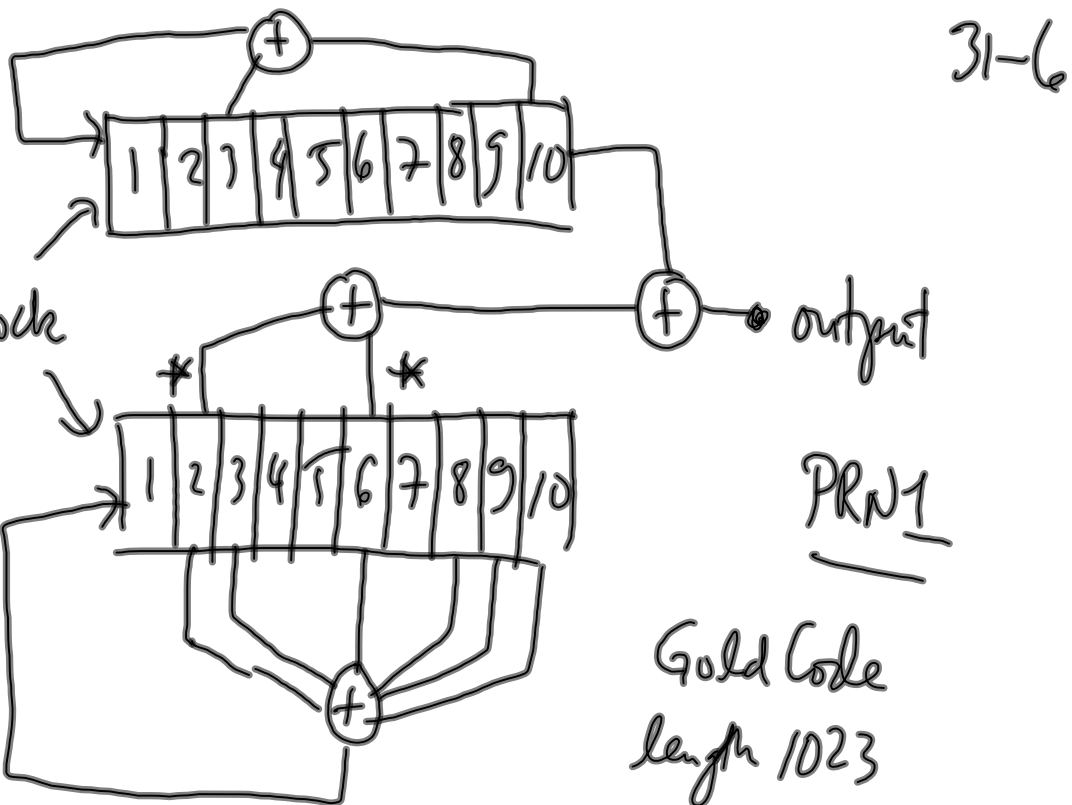


Nov 4-9:27 AM

Output of LFSR seq. of 0's + 1's
 appears random, but not

PRN code 1-32 same as sat#

Nov 4-9:27 AM



* changed 2-32

Nov 4-9:27 AM

properties of Gold code

31-7

32 PRN codes are orthogonal to each other
each PRN code orthogonal to itself when
Not aligned

Correlation $\Sigma = \begin{bmatrix} \sigma_x^2 & \sigma_{xy} \\ \sigma_{xy} & \sigma_y^2 \end{bmatrix}$

corr. coeff. $r_{xy} = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$ range $-1 \rightarrow +1$

Nov 4-9:27 AM

Sample covariance

$$\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{N-1} = S_{xy} \quad 31-8$$

Sample correlation
coeff

$$\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{(N-1) S_x S_y} = \hat{r}_{xy}$$

$$S_x = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N-1}}$$

$$S_y = \sqrt{\frac{\sum (y_i - \bar{y})^2}{N-1}}$$

$$\left(\frac{\sigma_{xy}}{\sigma_x \sigma_y} \right)$$

Nov 4-9:27 AM

$$\text{Sample CC} : \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{[\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2]^{1/2}} \quad \left. \vphantom{\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{[\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2]^{1/2}}} \right\} 31-9$$

Applications: image matching
 feature detection
 target detection
 radar matched filtering
 GPS acquisition

time domain, spacedomain, freq. domain
 SLOW FAST

Nov 4-9:27 AM

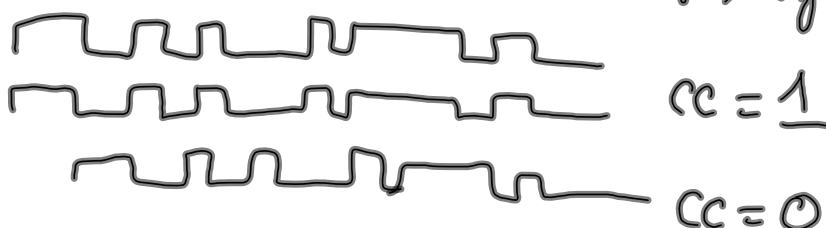
Freq. Domain Correlation (fast) 31-10

Convolution

convolution $g * h \leftrightarrow G(f)H(f)$
 g, h time domain, G, H fourier transforms

correlation $\text{corr}(g, h) \leftrightarrow G(f)H^*(f)$

* complex conjugate



Nov 4-9:27 AM

cross corr i, k @ lag m

31-11

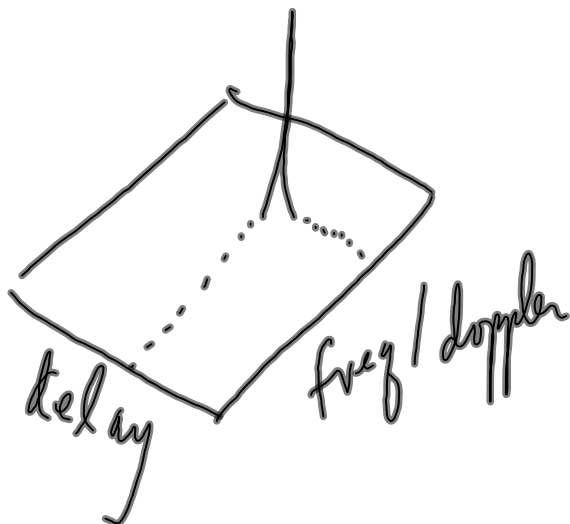
$$r_{ik} = \sum_{l=0}^{1022} \underline{c^i(l) c^k(l+m)} \approx 0$$

auto corr i, k @ lag m

$$r_{kk}(m) = \sum_{l=0}^{1022} c^k(l) c^k(l+m) \approx 0$$

except $m=0 \approx \underline{1023}$

Nov 4-9:27 AM



31-12

Nov 4-9:27 AM