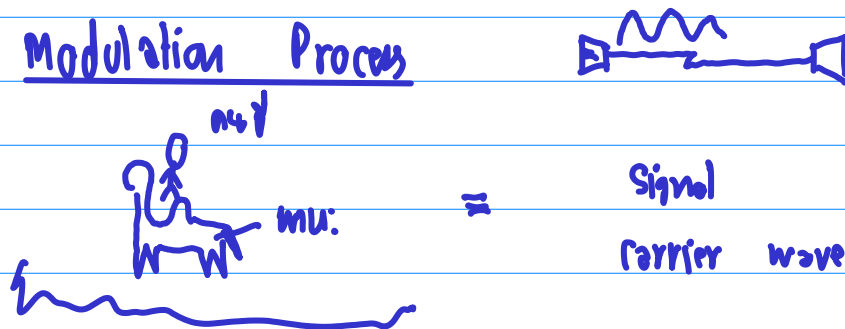


④ Modulation Process

④ ทฤษฎีการสื่อสาร: พลังงานสัญญาณ



Modulation Process = แปลง message signal ให้อยู่ในรูป

ของคลื่นแม่เหล็กไฟฟ้า ซึ่งสามารถส่งไปรับกันได้

โดยที่ $\text{Bandwidth} \propto \text{Power}$ และ $\text{Power} \propto \text{Bandwidth}$

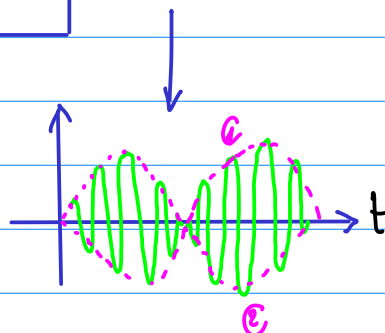
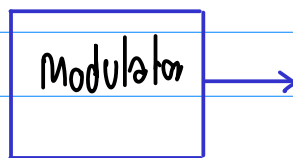
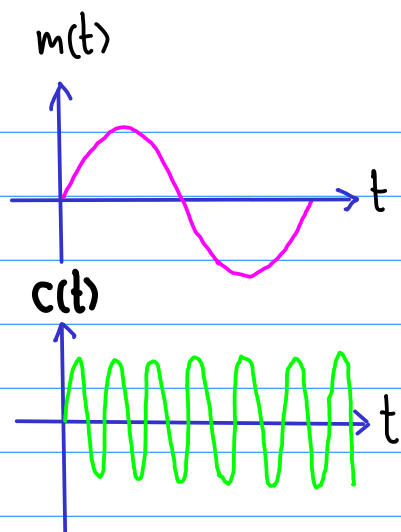
Modulation Process แบ่งเป็น 2 ประเภท

④ Continuous-wave modulation

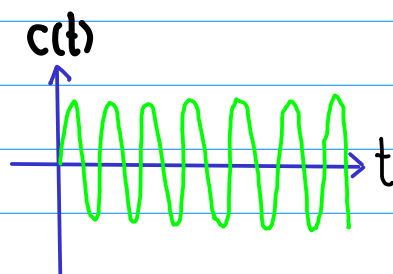
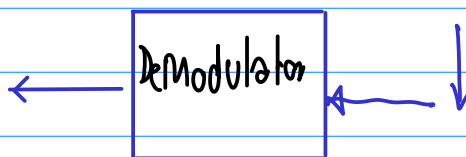
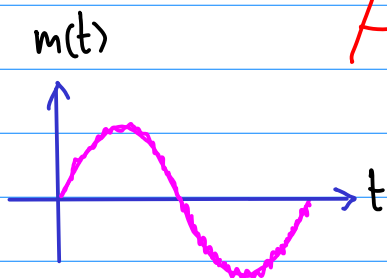
ใช้คลื่นแม่เหล็กไฟฟ้า Sinusoidal เป็นตัวนำ

Amplitude Modulation (AM)

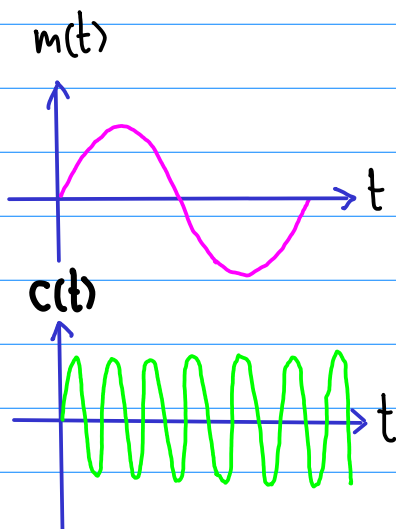
FM & PM



AM

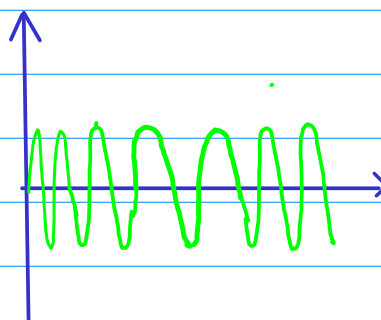


FM



\Rightarrow

FM signal

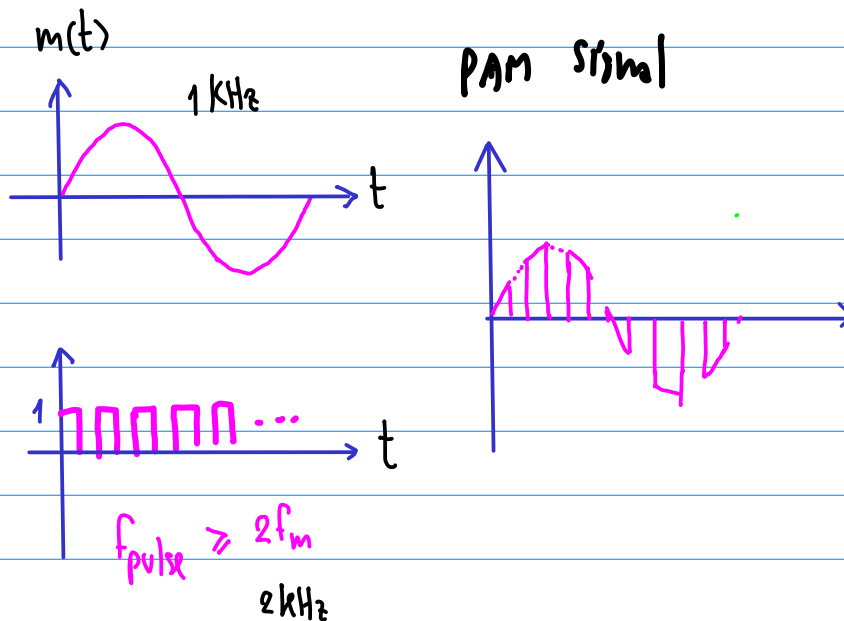


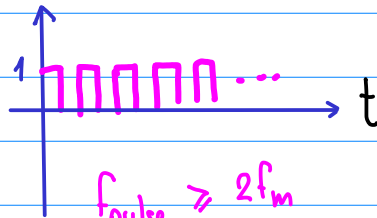
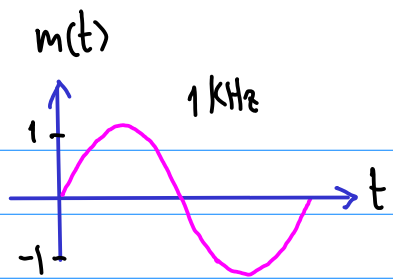
② Pulse Modulation

②.1 Analog : PAM (Pulse Amplitude Modulation)
PPM (Pulse Position Modulation)
PDM (Pulse Duration Modulation)

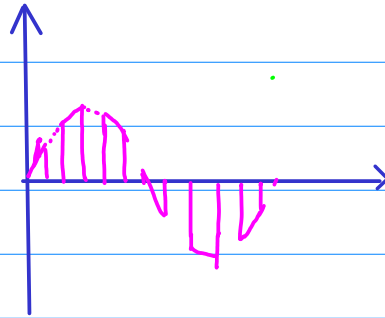
②.2 Digital

Analog Signal : Signal is continuous time $\left\{ \begin{array}{l} \text{piecewise} \\ \text{continuous} \end{array} \right.$ over domain
Digital Signal : Signal vary over sequence of discrete time





PAM signal



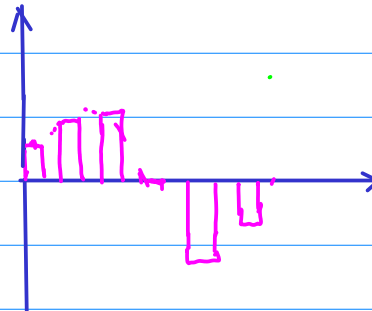
Quantizer

$$f: \mathbb{R} \rightarrow \{z_i\}_{i=1}^n$$

$$z_i \in \{-1, -0.9, -0.8, -0.7, \dots, 1\}$$

$$i \in \mathbb{Z}$$

PCM



source coding

$$C: \{z_i\}_{i=1}^n \rightarrow \{Z_2^8\}$$

$$0.9 \mapsto 10001111$$

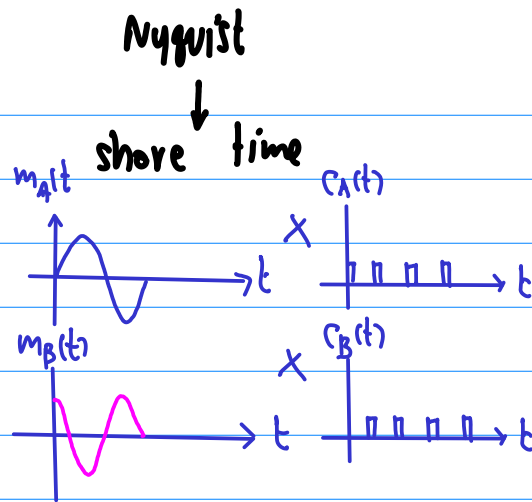
Analog & Digital Modu.

- ① minimum noise
- ② Flexible
- ③ Integration many many applications min

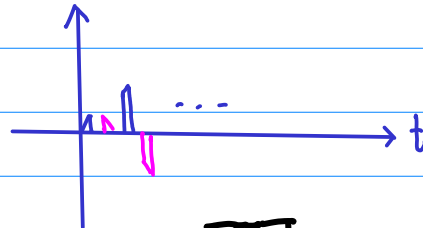
④ Security:



shore mu:, nu:



$$m_A(t)c_A(t) + m_B(t)c_B(t)$$



Multiplexing

① Time Division Multiplexing

② freq. Division Multiplexing

③ Code Division "

④ Wave length " "

