



# 社会生活と情報通信システム

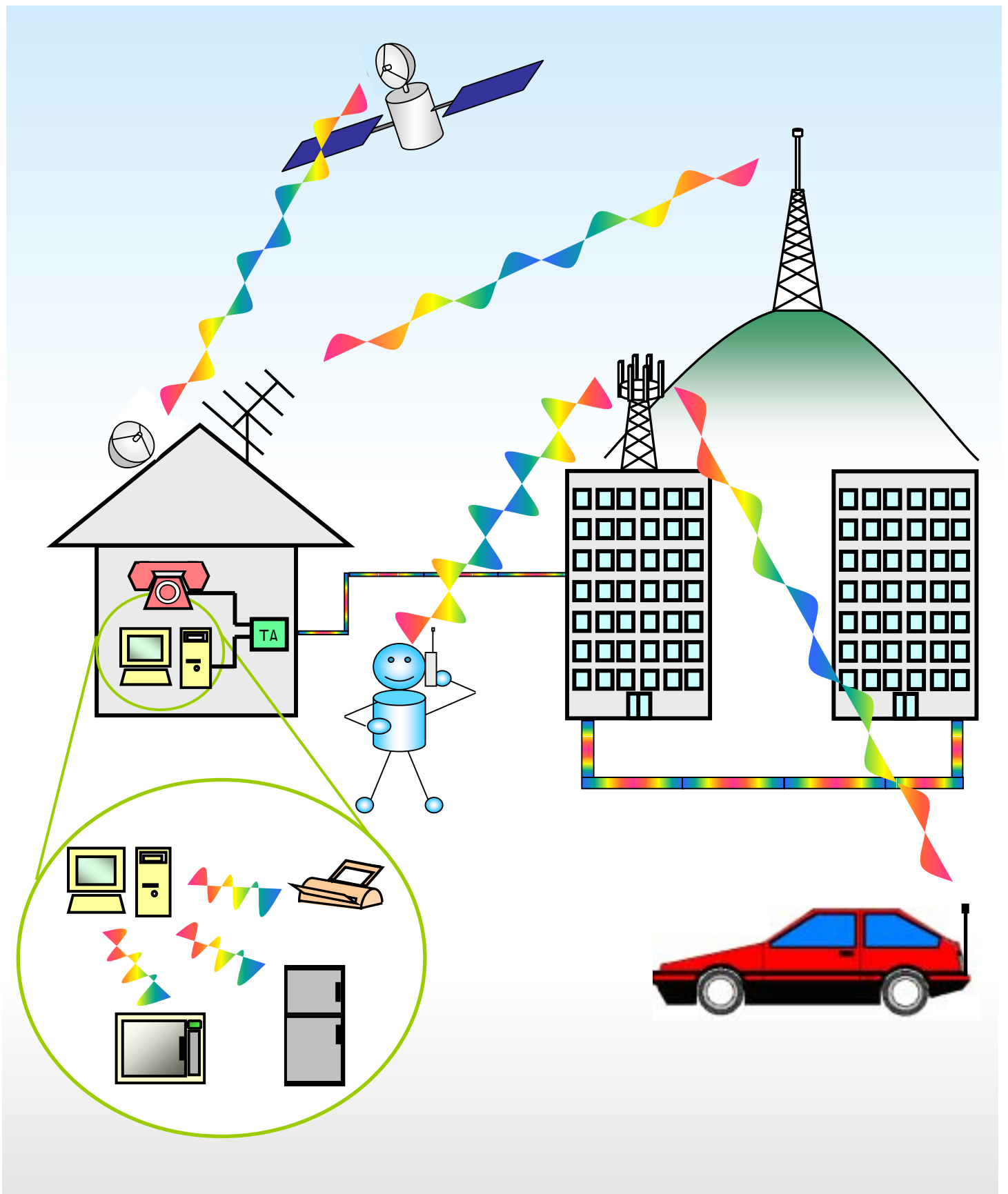
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北見工業大学

電気電子工学科

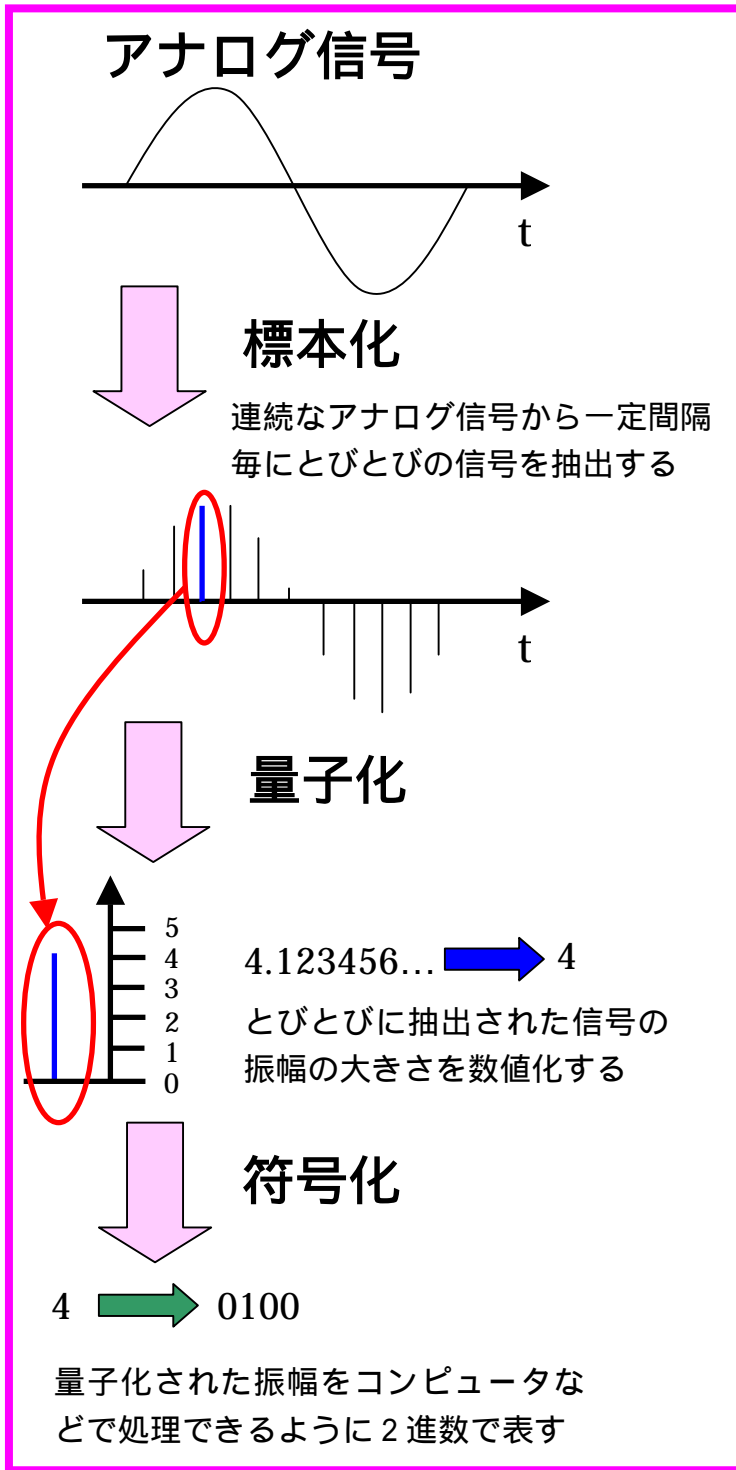
柏 達也

# 社会生活と情報通信システム

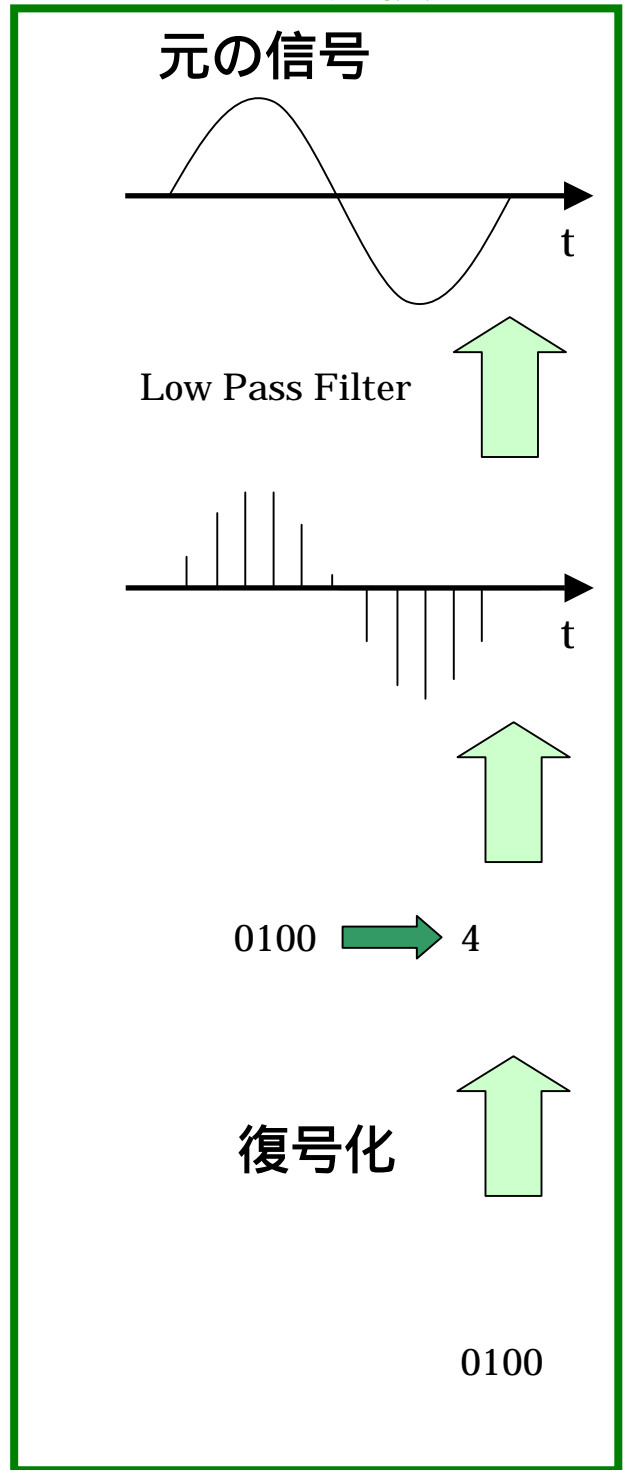


# 通信システム

## A/D 変換



## D/A 変換



**符号化**  
(圧縮, 暗号化)

**変調**



**多元接続**

**復号化**  
(解読, 解凍)

**復調**

# 信号の変調方法

被変調信号  $f(t)$

$$f(t) = a(t) \sin( (t) \cdot t + (t) )$$

振幅変調

AM: Amplitude modulation  
ASK: Amplitude Shift Keying

位相変調

PM: Phase modulation  
PSK: Phase Shift Keying

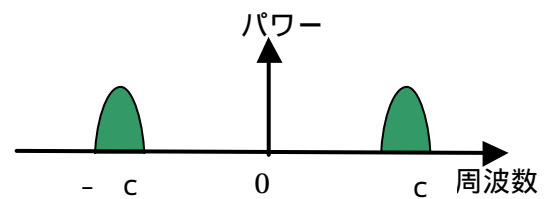
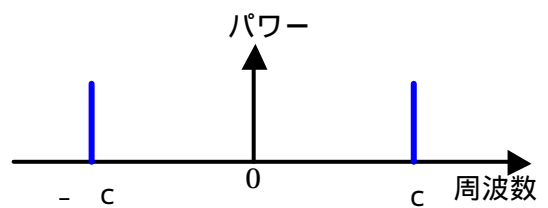
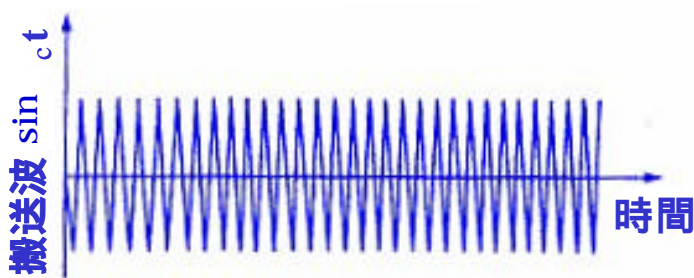
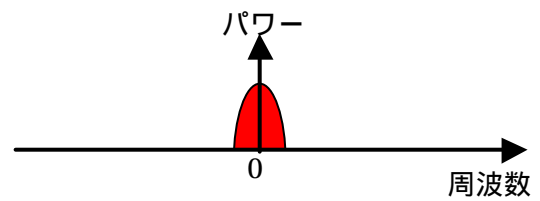
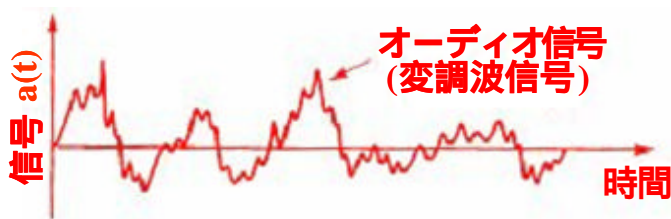
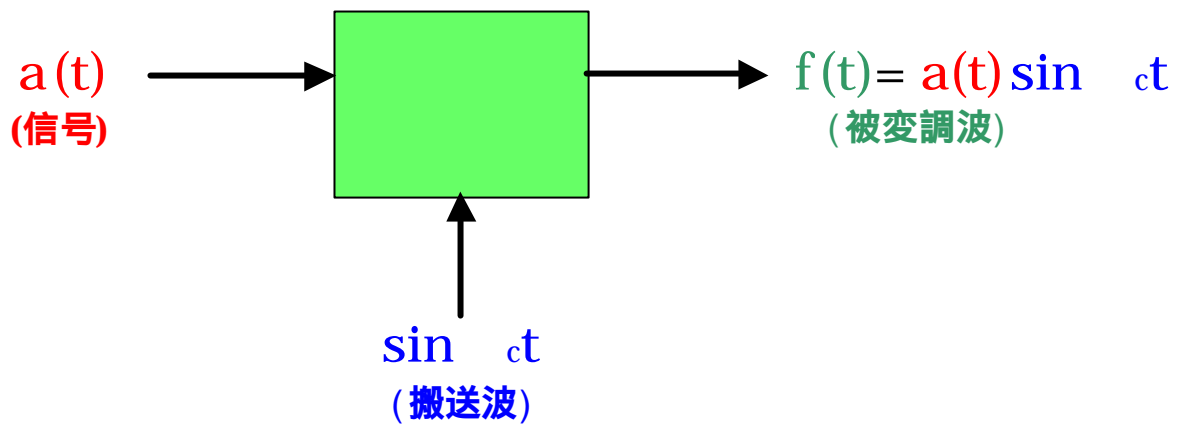
周波数変調

FM: Frequency modulation  
FSK: Frequency Shift Keying

# 信号の変調

## 振幅変調の場合

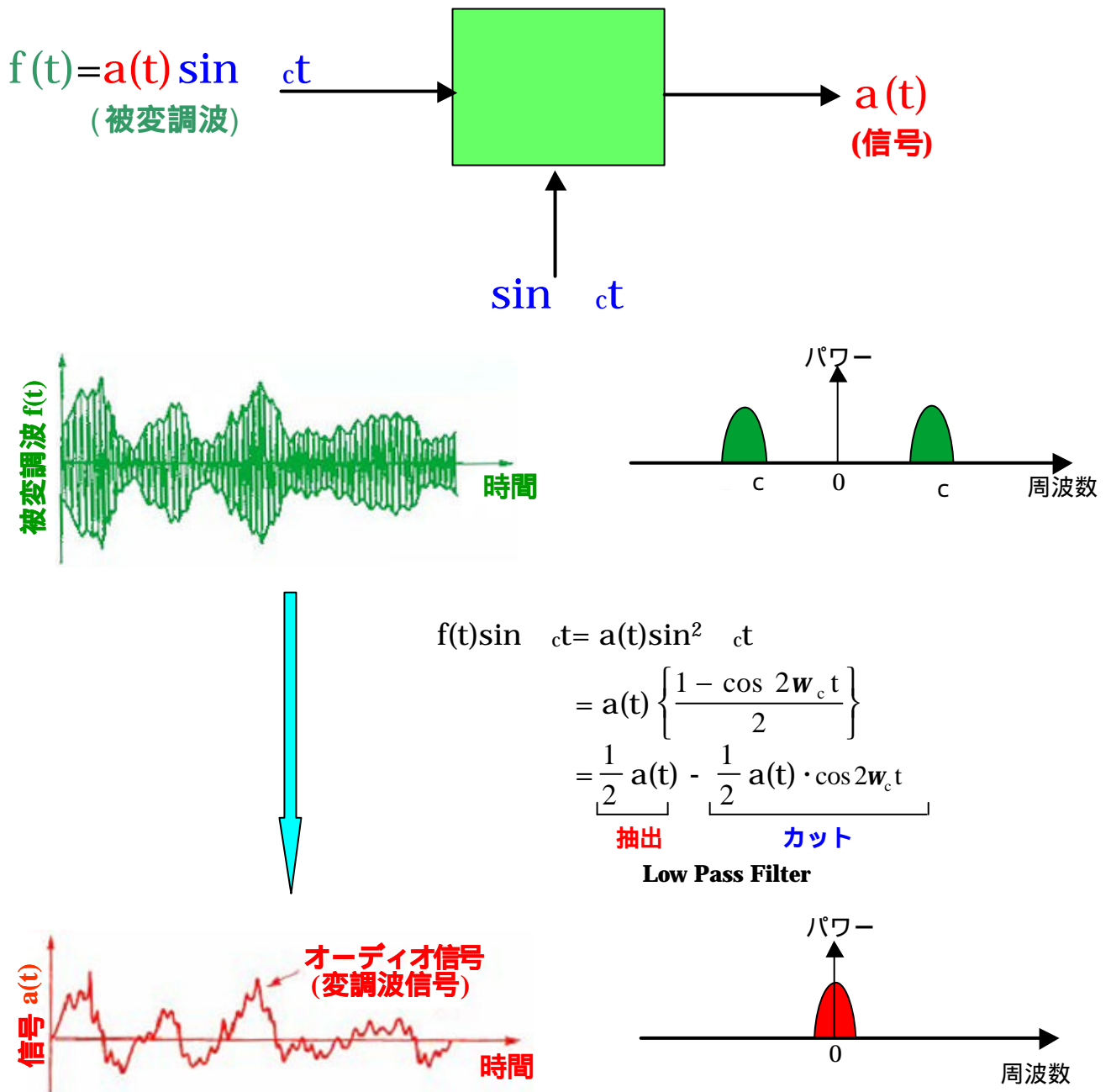
(概念的説明)



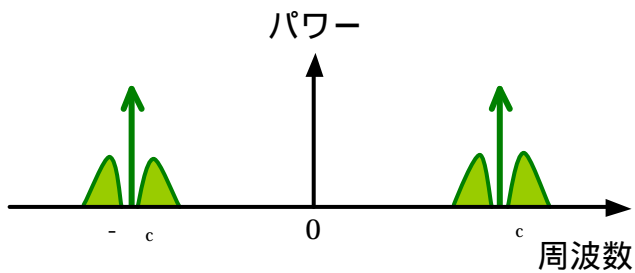
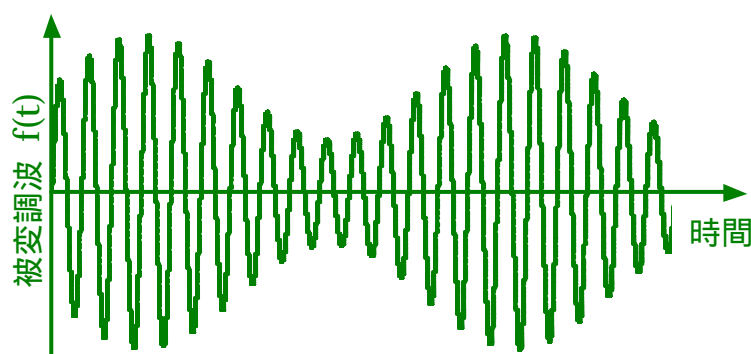
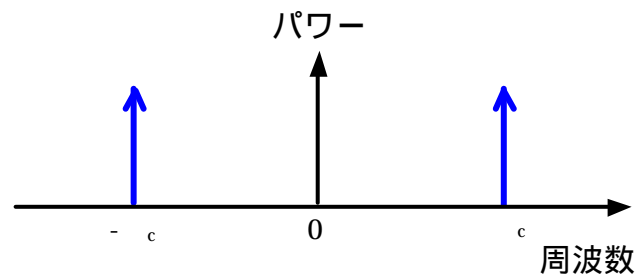
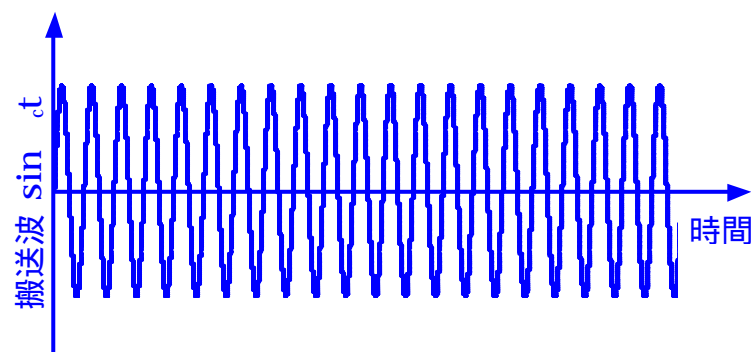
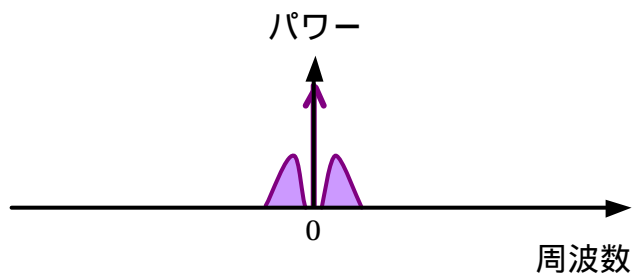
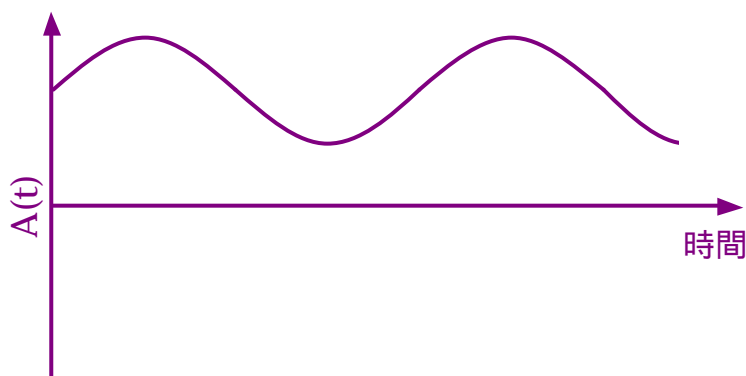
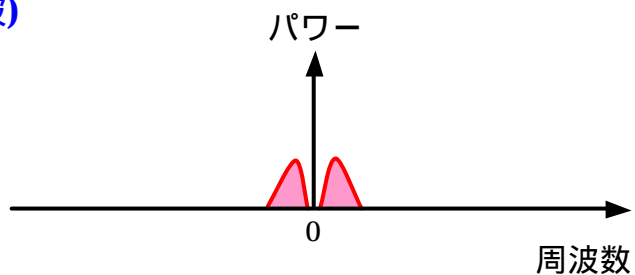
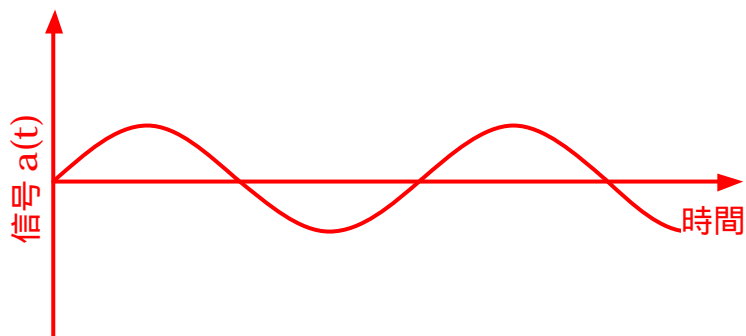
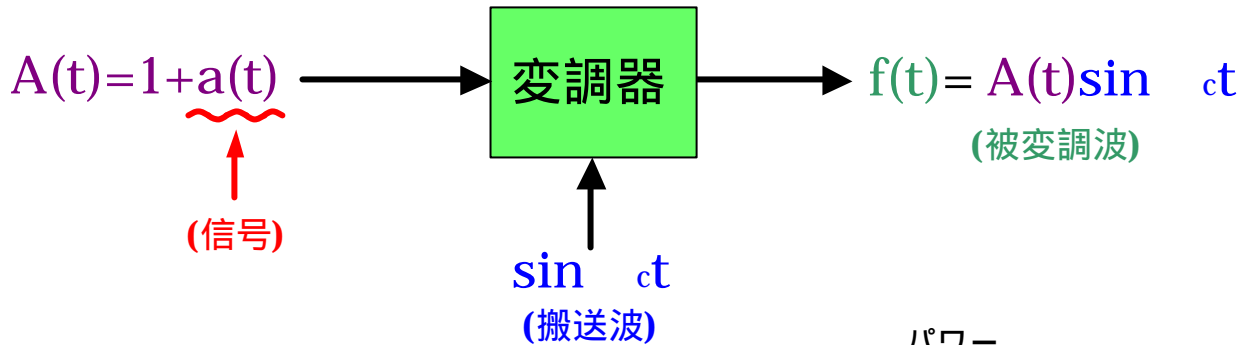
# 信号の復調

## 振幅復調の場合

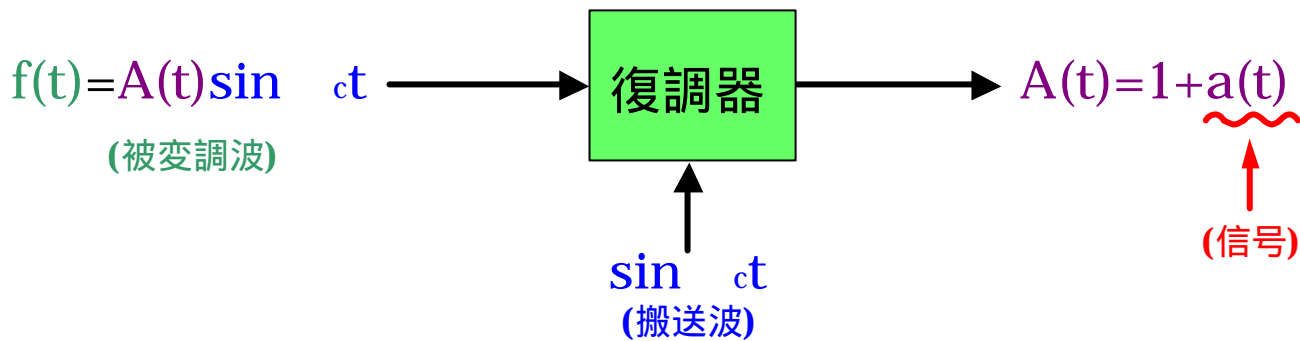
(概念的説明)



# AM 変調

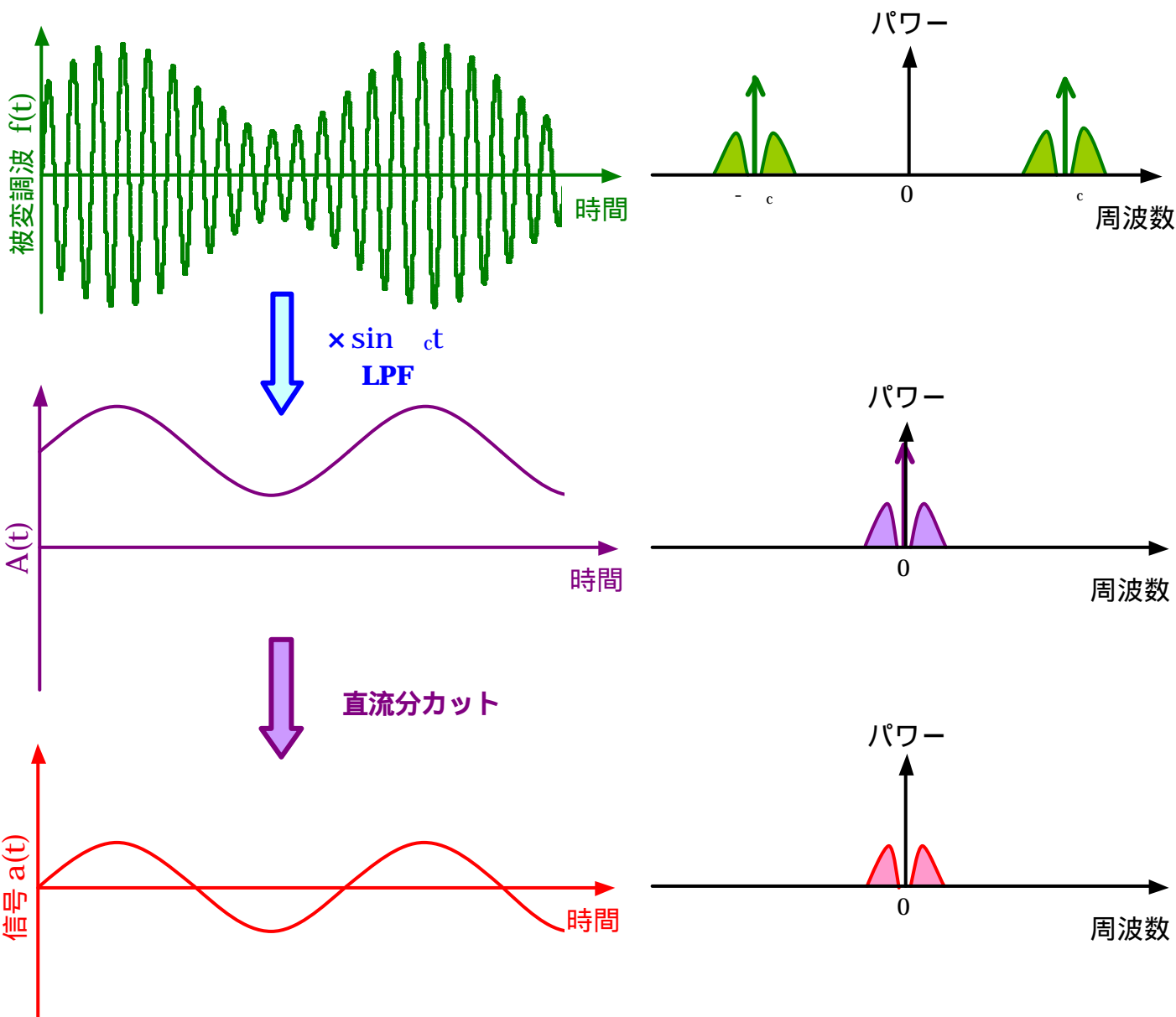


# AM 復調



$$\begin{aligned}
 f(t)\sin ct &= \{1+a(t)\}\sin^2 ct \\
 &= \{1+a(t)\} \cdot \frac{1}{2} (1 - \cos 2ct) \\
 &= \frac{1}{2} \{1+a(t)\} - \frac{1}{2} \{1+a(t)\}\cos 2ct
 \end{aligned}$$

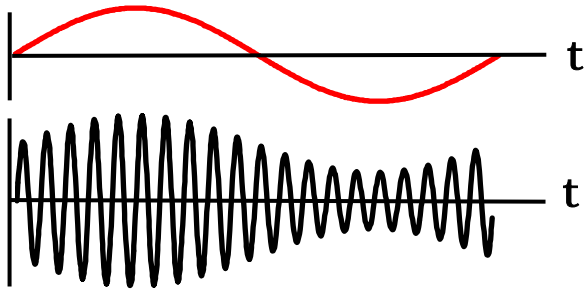
The first term  $\frac{1}{2} \{1+a(t)\}$  is labeled **抽出** (Extraction) and passes through a **Low Pass Filter**.  
 The second term  $-\frac{1}{2} \{1+a(t)\}\cos 2ct$  is labeled **カット** (Cut) and is filtered out.



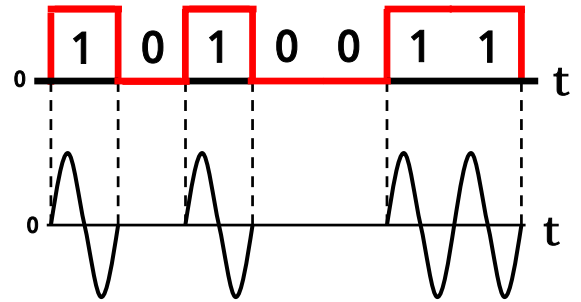


# 通信方式

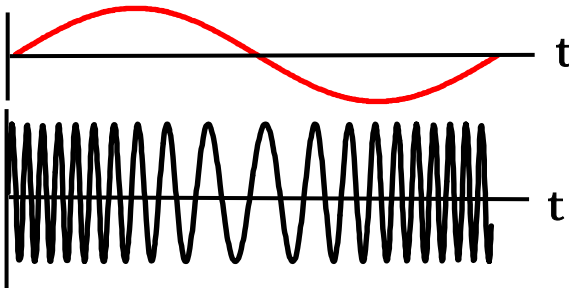
AM (振幅変調)  
アナログ信号



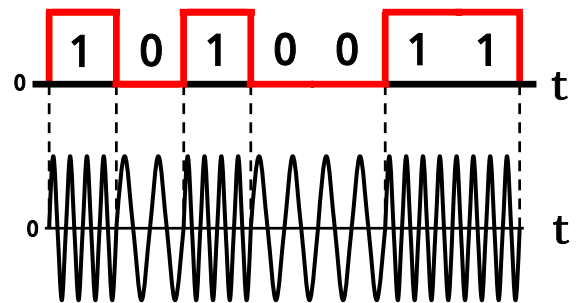
ASK (振幅変調)  
デジタル信号



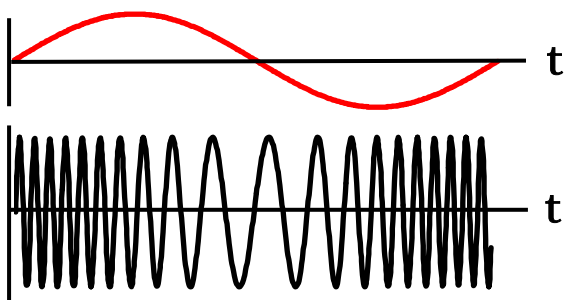
FM (周波数変調)  
アナログ信号



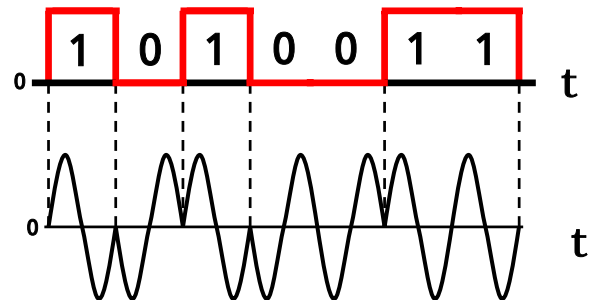
FSK (周波数変調)  
デジタル信号



PM (位相変調)  
アナログ信号



PSK (位相変調)  
デジタル信号



# データ圧縮

JPEG (Joint Photographic Coding Experts Group)

静止画像の圧縮方式

デジタルカメラ

インターネット

MPEG (Moving Picture Experts Group)

動画及び音声の圧縮方式

◆MPEG1

Video CD

MP3 (MPEG1 Audio Layer3)

◆MPEG2

DVD

デジタルテレビ放送

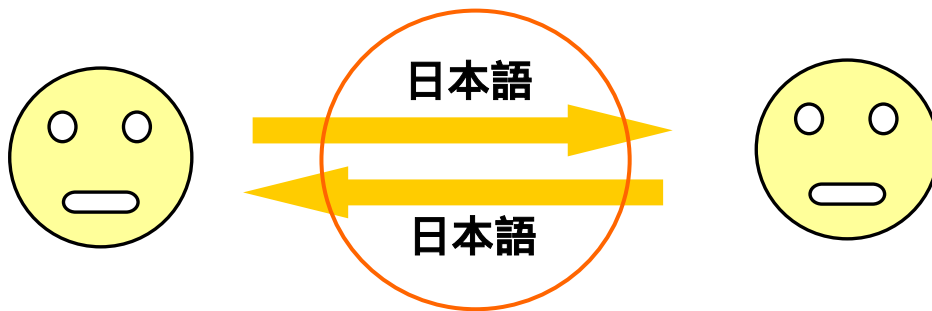
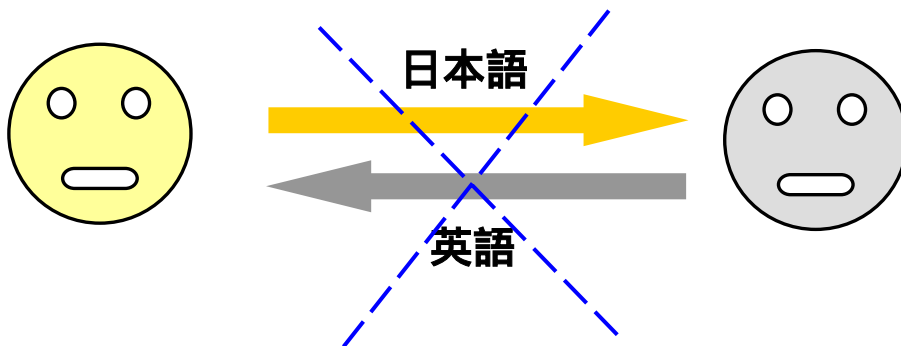
◆MPEG4

携帯電話、アナログ回線等低速度通信用の動画規格

# 通信プロトコル

TCP/IP

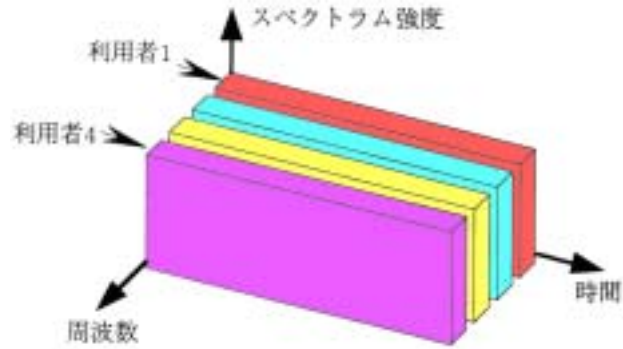
OSI 参照モデル



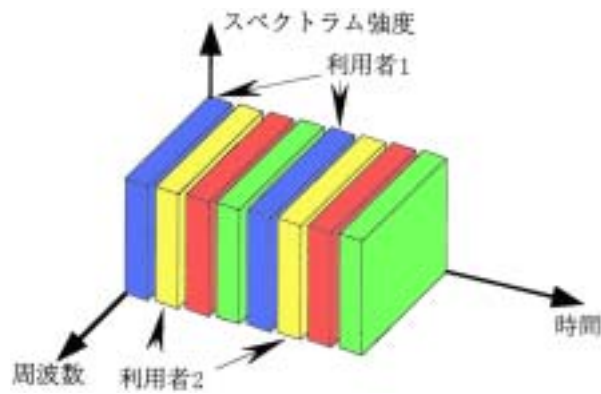
通信プロトコル

(通信規約)

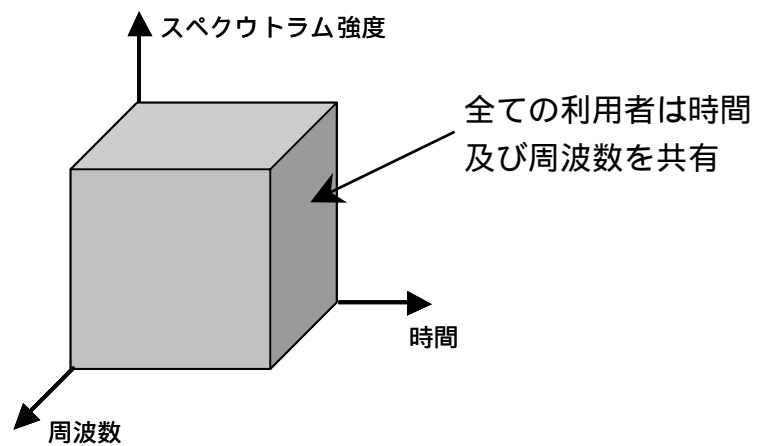
# 多元接続



FDMA (Frequency Division Multiple Access)

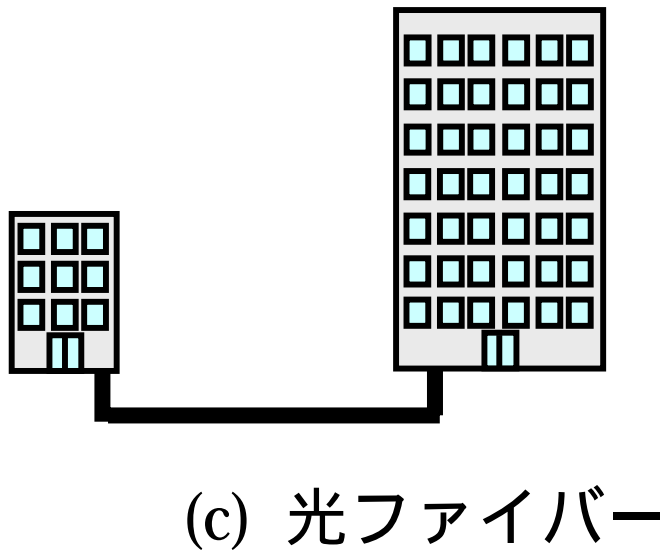
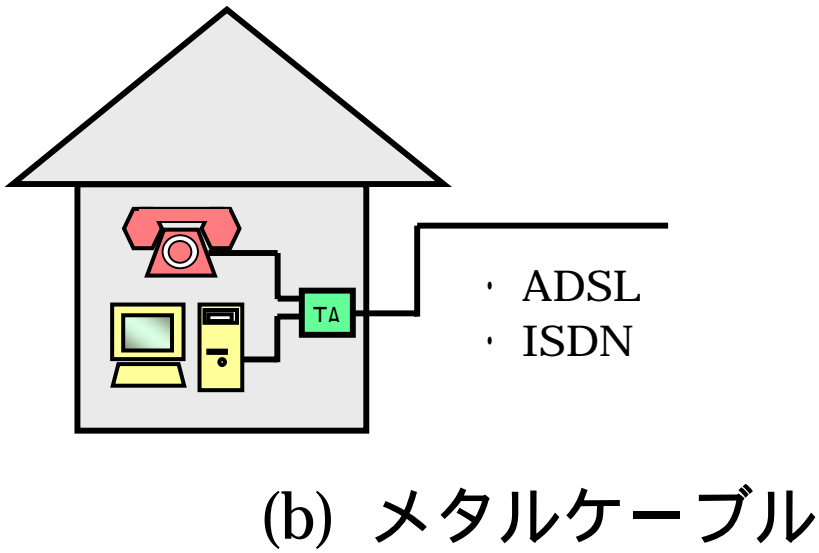
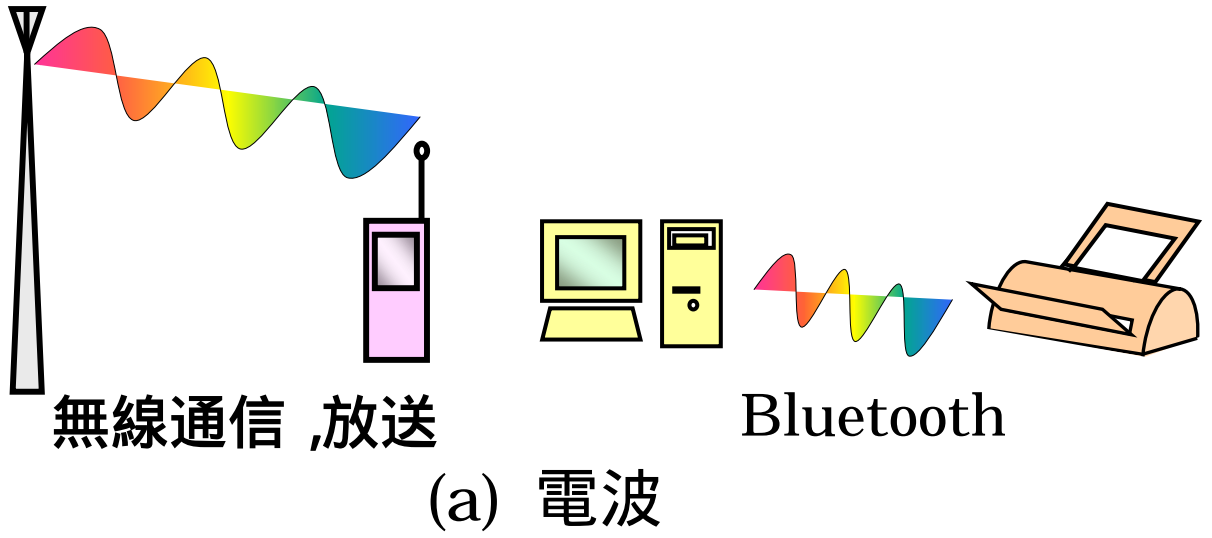


TDMA (Time Division Multiple Access)



CDMA (Code Division Multiple Access)

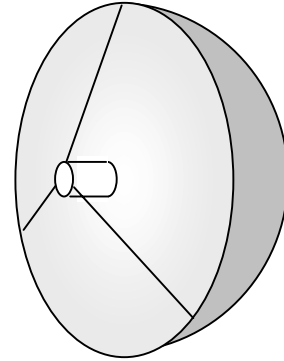
# 伝送媒体



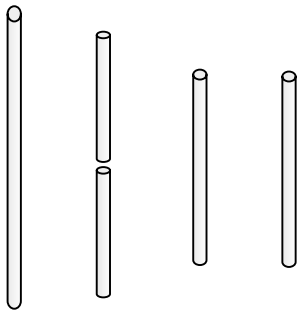
# アンテナ



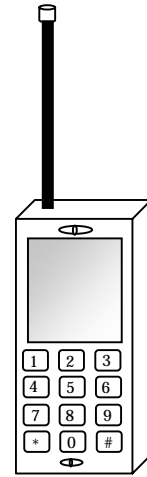
ダイポールアンテナ



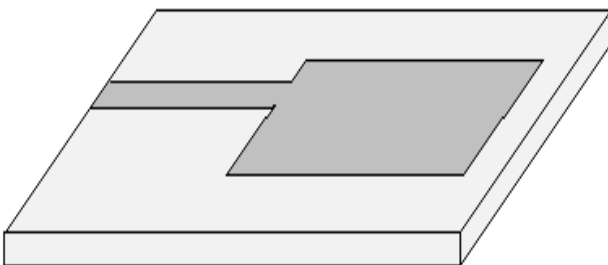
パラボラアンテナ



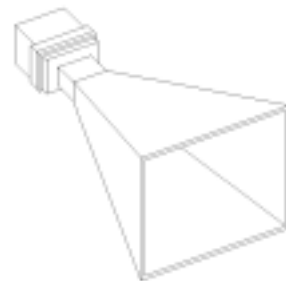
八木・宇田アンテナ



モノポールアンテナ

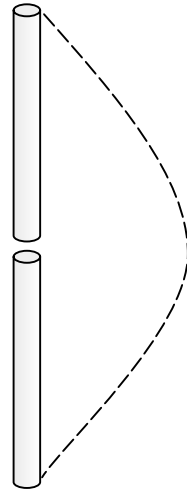


マイクロストリップアンテナ

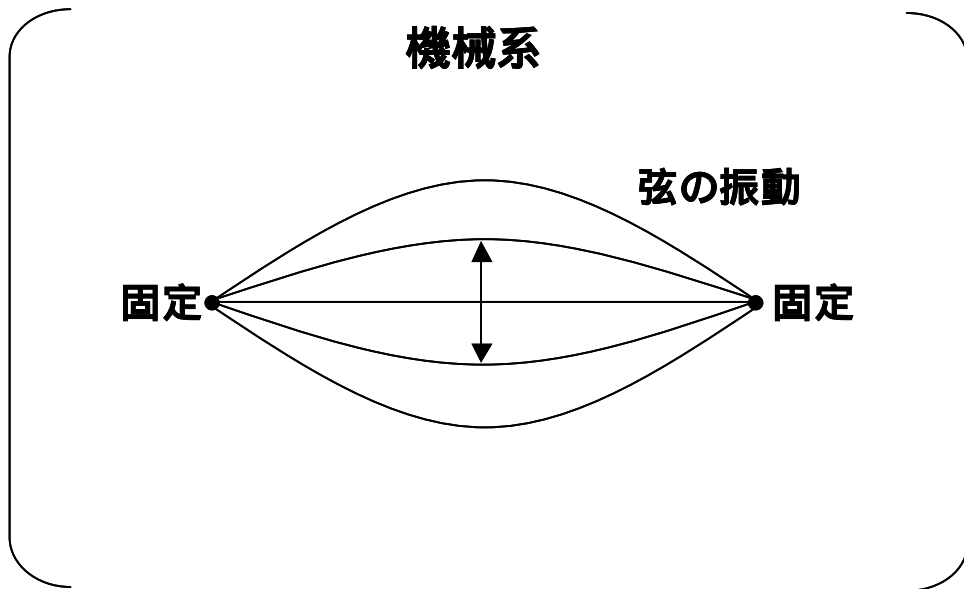


ホーンアンテナ

# ダイポールアンテナの原理

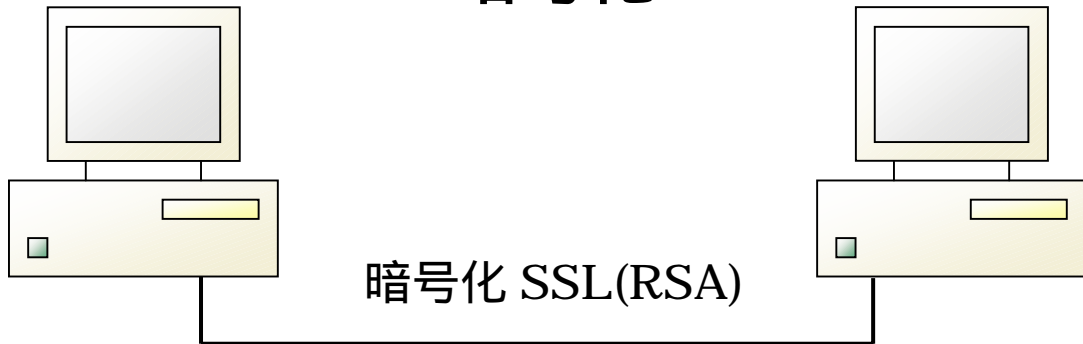


電流分布  
(共振)

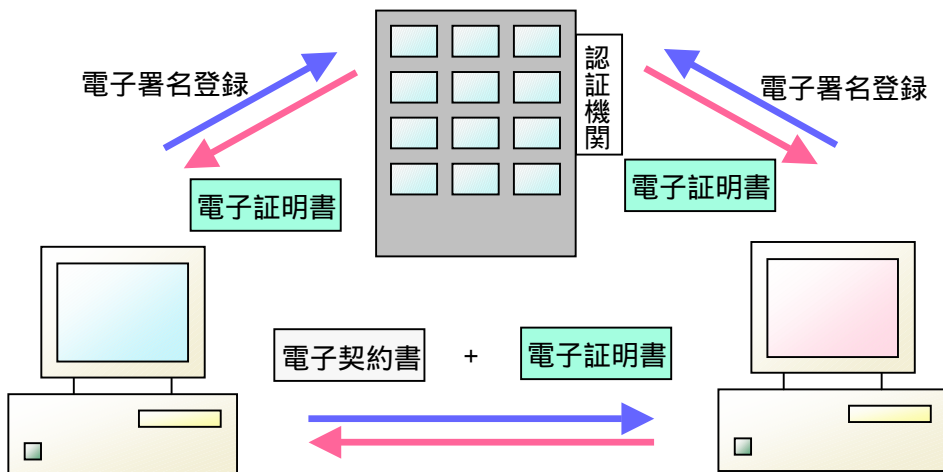
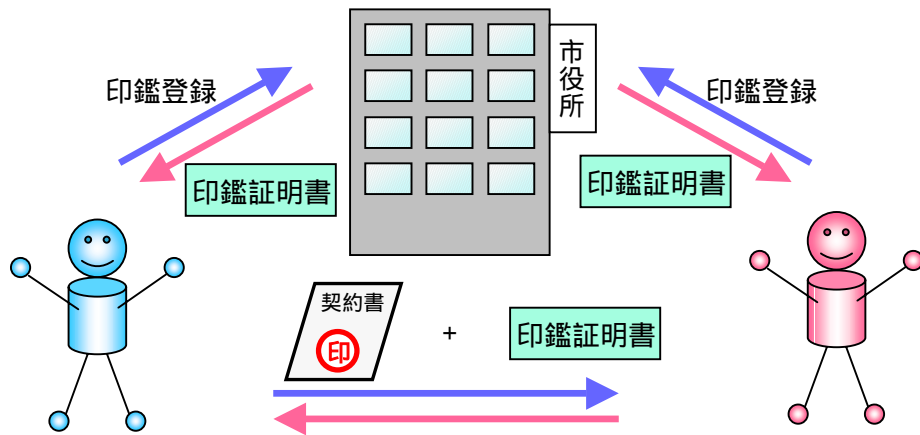


# セキュリティ

## 暗号化



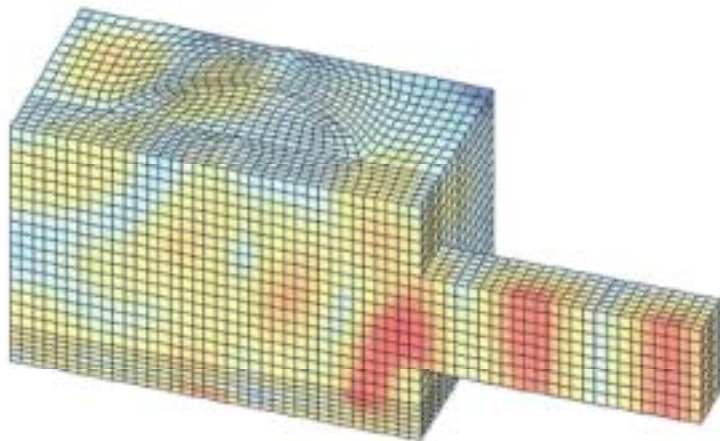
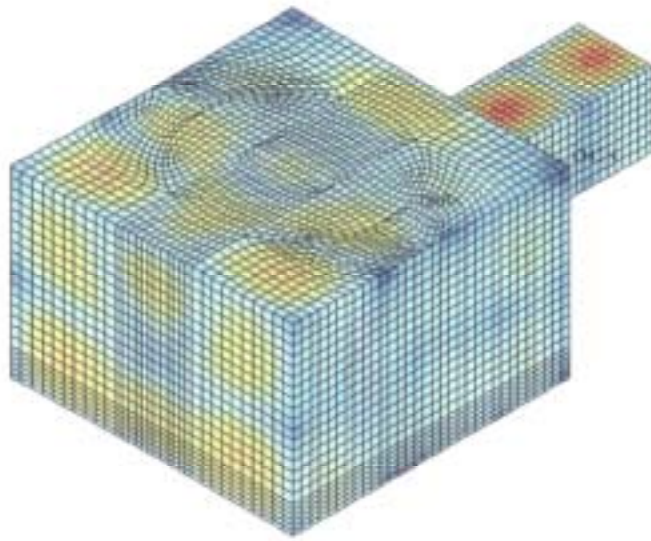
## 電子認証





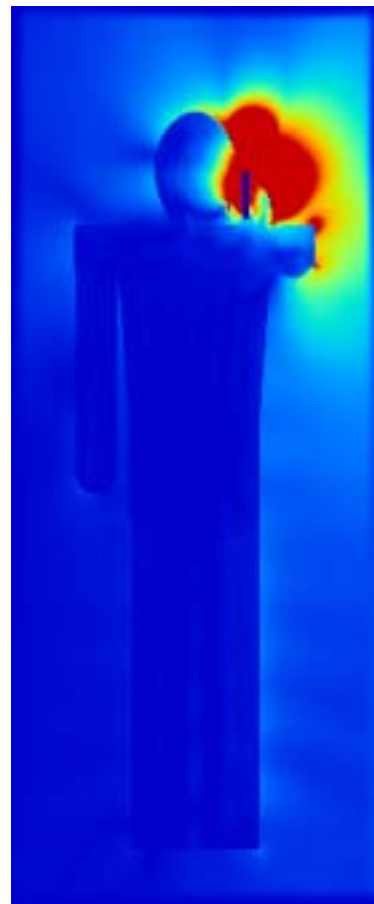
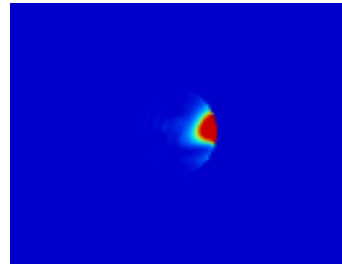
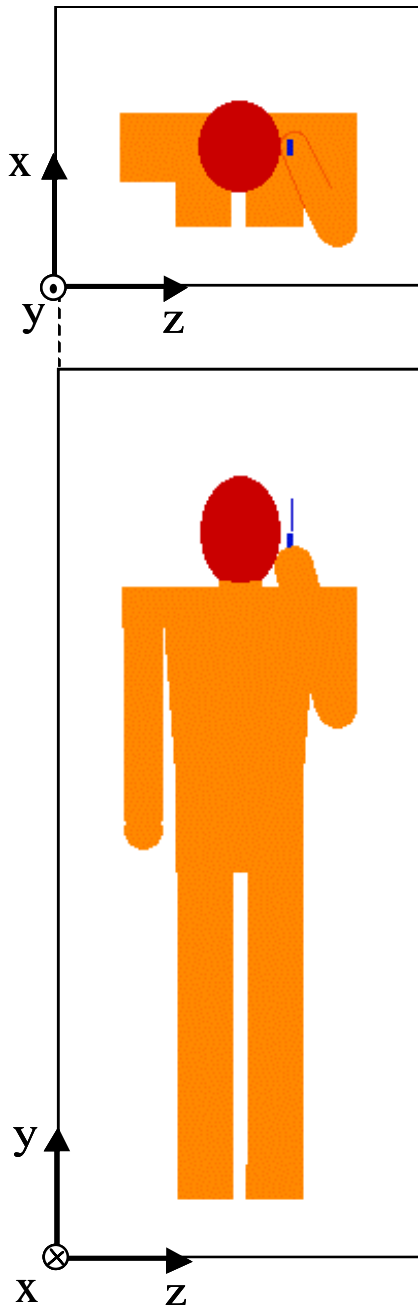
# 環境電磁

電子レンジ内の電界分布



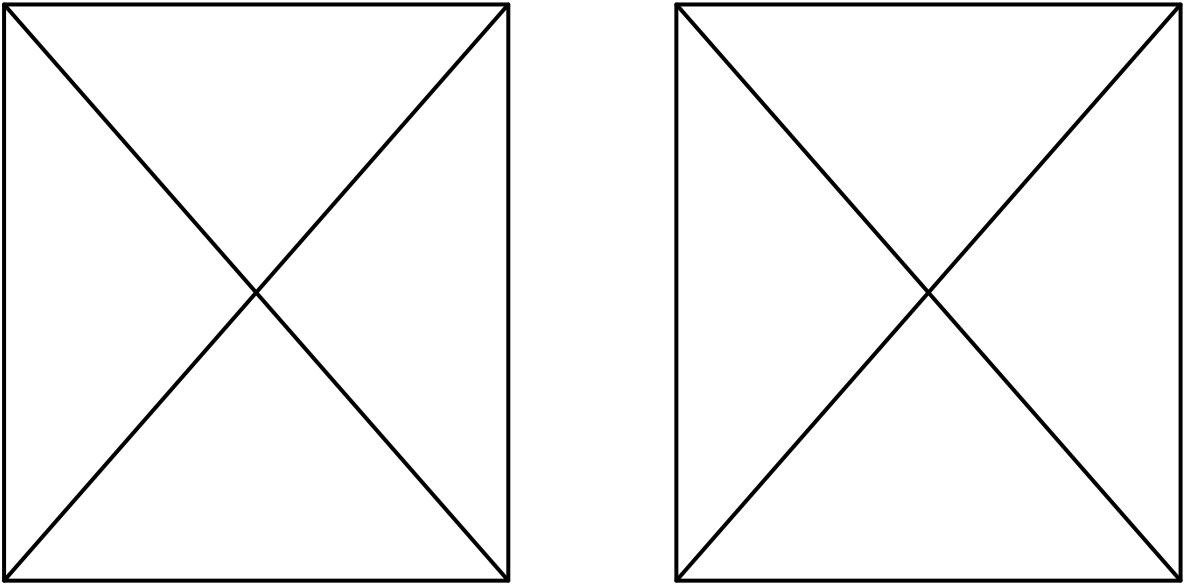
# 環境電磁

## 携帯電話と人体頭部の相互作用



# 環境電磁

## 電波暗室



## 自動車搭載アンテナ特性

