數位電路設計

9/17

Texebook: Digital Design 5th by Michael D. Ciletti and M. Morris Mano  5/e

Grading:

* pop quiz 30%
* midterm exam 35%
* final exam 35%

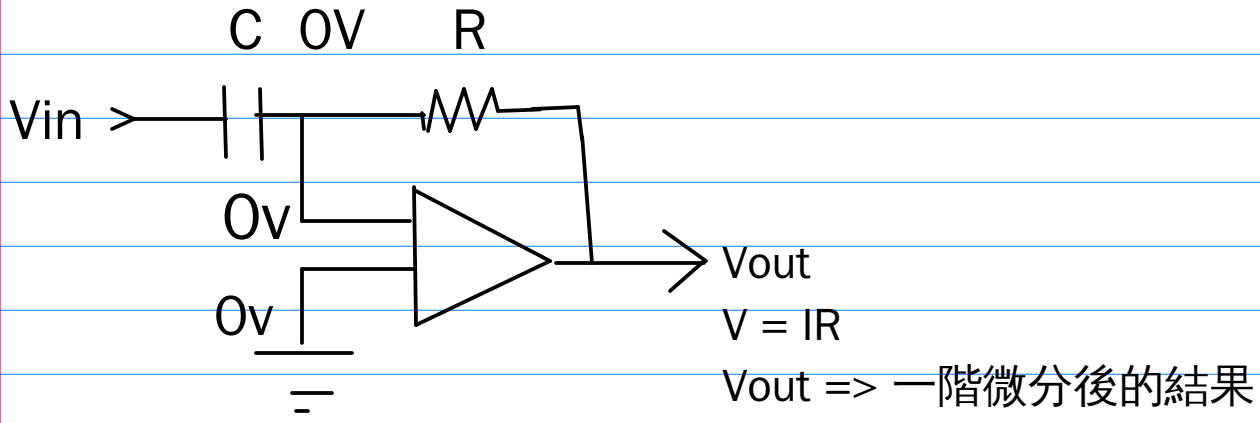
9/20

電容具有這個特性：  i = C (dv/dt)

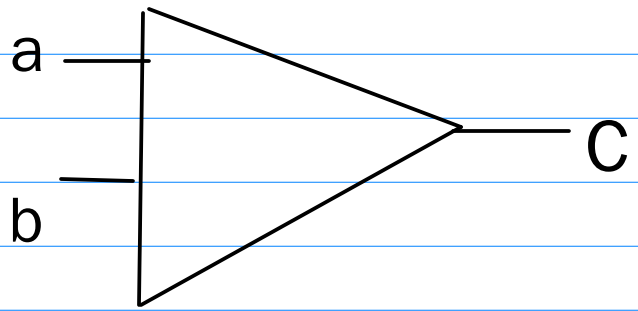
所以可以拿來算微分 / 積分：

dv => function f(x)

i -> function  f'(x)




放大器：回饋電路  A * (Va - Vb) = Vc



類比電路：

- 優雅 => 像是藝術一般
- 元件的不精確性 => 可能會有雜訊
- 元件的工作電壓通常為非線性
- 不容易 scale up

數位電路：

- Programmable
- more robust to error, error correction
- eazy to reuse or scale up

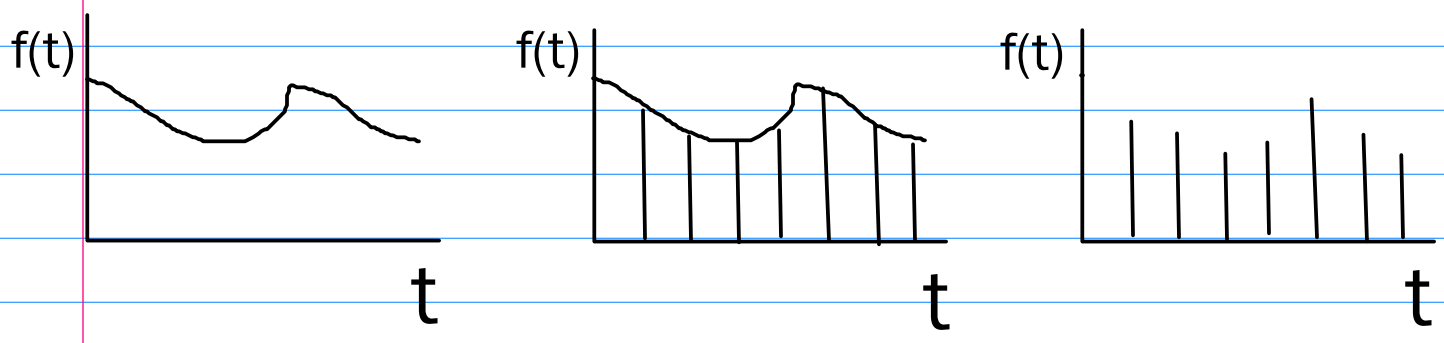
Digital System：

- interconnect of digital modules
- using HDL (hardware description language) to design
- HDL => compiler （電路合成）=> 電路

Behavier ======> Dataflow =======> structure
abstract implement

Signal:

- a function of time / space
- all signal are analog by nature




Analog discrete time digital signal

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Quantization

9/24

For digital systems, the variable takes on discrete values

Two level (binary) values are the most prevalent

Binary values are represented abstractly by:

- digits 0 and 1
- False and True
- Low and High
- On and Off

Digital Number Systems:

- only allow discrete numbers
- the base (radix) can be any positive integers ( > 1)
- base r to decimal

a(4) a(3) a(2) a(1) a(0) . a(-1) a(-2) # base r

r^4a(4) + r^3a(3) + r^2a(2) + r^1a(1) + r^0a(0) + r^(-1)a(-1) + r^(-2)a(-2) # decimal

binary / octal / hexadecimal
- arithmetic
    - addition
    - subtraction
    - Multiplication
- conversion

Signed Numbers:

God made the natural numbers; all else is the work of human
-- Leopold Kroncker

- Complements
- Sign-magnitude notation
- Excess notaion

Complements:
- radix complement
- dimished radix complement

- that is, in base-r system
    - r's complement
    - r-1's complement

- Ex.
    - 2's complement  # 0 => 0000
    - 1's complement  # +0 and -0 =>  0000  1111