FPGA系統設計\_第五章\_數值處理

**10867024 廖育賢**

# **objective- THE PROBLEM AND PURPOSE**

VHDL程式提供功能完整的數值計算功能，將複雜的電路用精簡的指令來完成，本實驗進行數值計算與比較運算的指令練習。

# **procedure – DESIGN methods**

## 外部電路配置:

使用基本測試模組，功能為按鍵輸入與LED燈輸出，其中4組按鍵輸入訊號以XC(3~0)定義，選擇12組LED燈輸出訊號以XA(3~0)和XB(7~0) 定義。

## 內部電路設計:

1. 在architecture和begin中間以signal將A與B訊號事先宣告。
2. 此實驗以兩個2位元之數值做計算，故須以4位元儲存之。
3. 比較運算指令之結果為布林格式，無法輸出，因此先用when-else將之轉換為STD\_LOGIC形式後再輸出之。

# **simulation results**

## program codes

### **ch05.vhd**

library IEEE;

use IEEE.std\_logic\_1164.all;

use IEEE.std\_logic\_arith.all;

use IEEE.std\_logic\_unsigned.all;

entity CH04 is

port

( XB : out STD\_LOGIC\_VECTOR (7 downto 0);

XC : in STD\_LOGIC\_VECTOR (3 downto 0)

); --The IEEE standard 1164 package, declares std\_logic, rising\_edge(), etc.

library IEEE;

use IEEE.std\_logic\_1164.all;

use IEEE.std\_logic\_arith.all;

use IEEE.std\_logic\_unsigned.all;

entity CH05 is

port

( XA : out UNSIGNED (3 downto 0);

XB : out UNSIGNED (7 downto 0);

XC : in UNSIGNED (3 downto 0)

);

end CH05;

architecture CH05\_ARCH of CH05 is

signal A,B : UNSIGNED (1 downto 0); --internal signals

begin

A <= XC(3 downto 2);

B <= XC(1 downto 0);

XB(1 downto 0) <= A + B; --test (A+B)

XB(3 downto 2) <= A - B; --test (A-B)

XB(7 downto 4) <= A \* B; --test (A\*B)

XA(0) <= '1' when A>=B else --test (A>=B)

'0';

XA(1) <= '1' when A>B else --test (A>B)

'0';

XA(2) <= '1' when A<B else --test (A<B)

'0';

XA(3) <= '1' when A=B else --test (A=B)

'0';

end CH05\_ARCH;

### **ch05.ucf**

NET XA<0> LOC = N2;

NET XA<1> LOC = T1;

NET XA<2> LOC = T2;

NET XA<3> LOC = U2;

NET XB<0> LOC = M3;

NET XB<1> LOC = M4;

NET XB<2> LOC = W3;

NET XB<3> LOC = W4;

NET XB<4> LOC = Y3;

NET XB<5> LOC = Y4;

NET XB<6> LOC = W6;

NET XB<7> LOC = Y6;

NET XC<0> LOC = V1;

NET XC<1> LOC = V2;

NET XC<2> LOC = W1;

NET XC<3> LOC = W2;

## observations

#### 輸入A:01,B:01，A+B為10(下圖XB(1)xb(0)), a-b為00(下圖XB(3)xb(2)), a\*b為0001(下圖XB(7)xb(6) xb(5) xb(4)) ,a>=b 得到輸出0(下圖Xa(0)), a>b得到輸出1(下圖xa(1)), a<b得到輸出1(下圖xa(2)), a=b得到輸出0(下圖XA(3))

### 