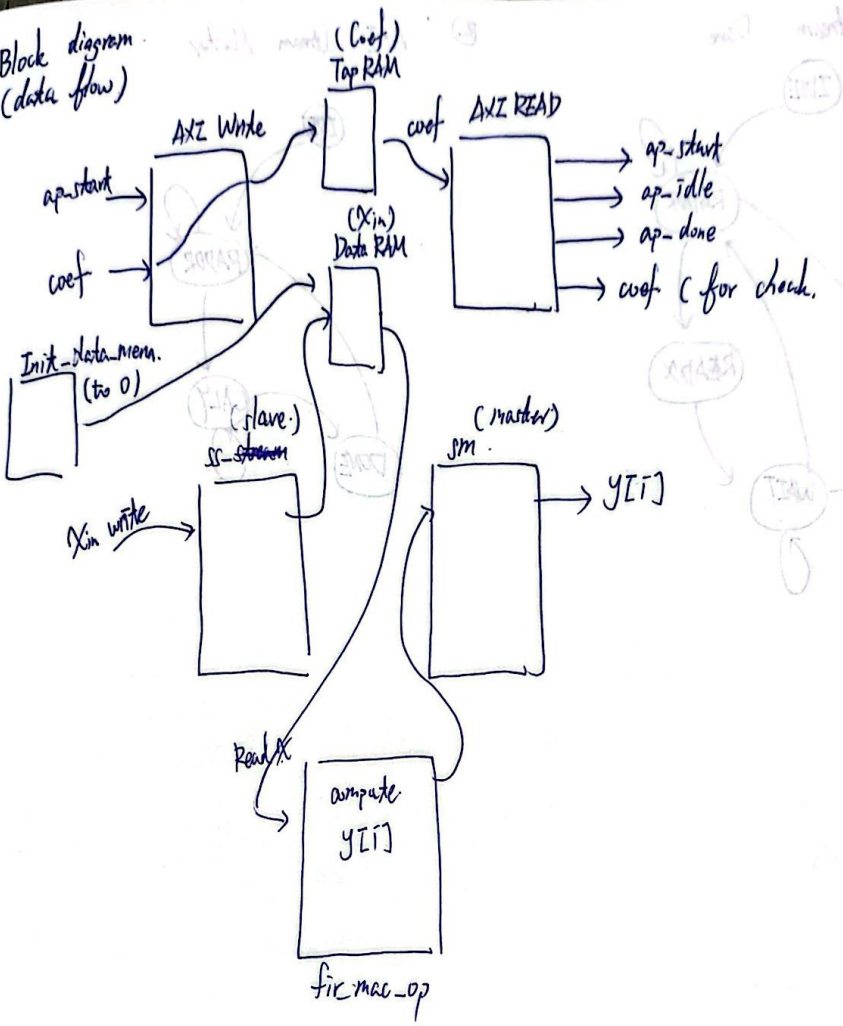
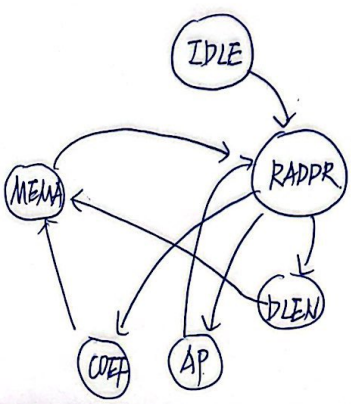
1. Block diagram (data flow)

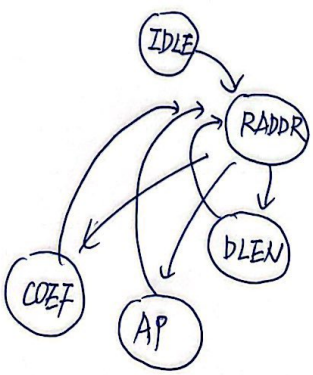


2. FSM.

(1) AXI Read.



(2) AXI Write



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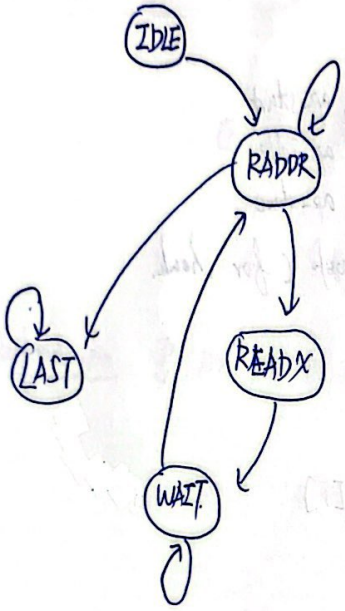
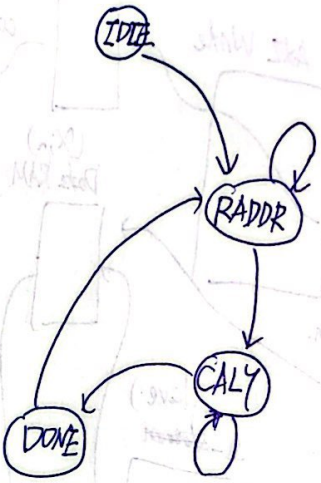
(3) AXI Stream Slave



(4) AXI Stream Master



Scanned with CamScanner

SoC Lab Lab3 – Fir Implementation

1. AP Signals generation and control:

(1) ap_done

```
always @(posedge axis_clk, negedge axis_rst_n) begin
    if(!axis_rst_n) begin
        ap_done_reg <= 0;
    end else if(ss_tlast) begin
        ap_done_reg <= 1;
    end else begin
        ap_done_reg <= ap_done_reg;
    end
end
```

(2) ap_start

```
always @(posedge axis_clk, negedge axis_rst_n) begin
    if(!axis_rst_n) begin
        ap_start_reg <= 0;
    end else if(ss_state_ps > SS_IDLE) begin//RESET after data start to process
        ap_start_reg <= 0;
    end else if(ap_start_r) begin
        ap_start_reg <= ~ap_start_reg;
    end else
        ap_start_reg <= ap_start_reg;
end
```

(3) ap_idle

pseudo code:

```
always @(*) begin
    case(ss_state_ps)
        SS_IDLE:
        SS_LAST:
            ap_idle_reg = 1
    endcase
end
```

2. Xin and Yout:

step1: initialize data memory with zeros

step2: read 1 Xin into data memory, and set ss_read1x_r = 1

step3: start to compute 1 Yout, and after finishing computation, set sm_finish_cal1y_r = 1

Note:

(1). The computation for Yout is done by the module named fir_mac_op

(2). The whole code uses only 1 multiplication and one addition

3. Time report:
(1). Setting

Timer Settings

Settings

Enable Multi Corner Analysis:	Yes
Enable Pessimism Removal:	Yes
Pessimism Removal Resolution:	Nearest Common Node
Enable Input Delay Default Clock:	No
Enable Preset / Clear Arcs:	No
Disable Flight Delays:	No
Ignore I/O Paths:	No
Timing Early Launch at Borrowing Latches:	No
Borrow Time for Max Delay Exceptions:	Yes
Merge Timing Exceptions:	Yes

Multi-Corner Configuration

Corner Name	Analyze Max Paths	Analyze Min Paths
Slow	Yes	Yes
Fast	Yes	Yes

(2). Summary

Design Timing Summary

Setup		Hold		Pulse Width	
Worst Negative Slack (WNS):	3.826 ns	Worst Hold Slack (WHS):	0.137 ns	Worst Pulse Width Slack (WPWS):	4.500 ns
Total Negative Slack (TNS):	0.000 ns	Total Hold Slack (THS):	0.000 ns	Total Pulse Width Negative Slack (TPWS):	0.000 ns
Number of Failing Endpoints:	0	Number of Failing Endpoints:	0	Number of Failing Endpoints:	0
Total Number of Endpoints:	228	Total Number of Endpoints:	228	Total Number of Endpoints:	131

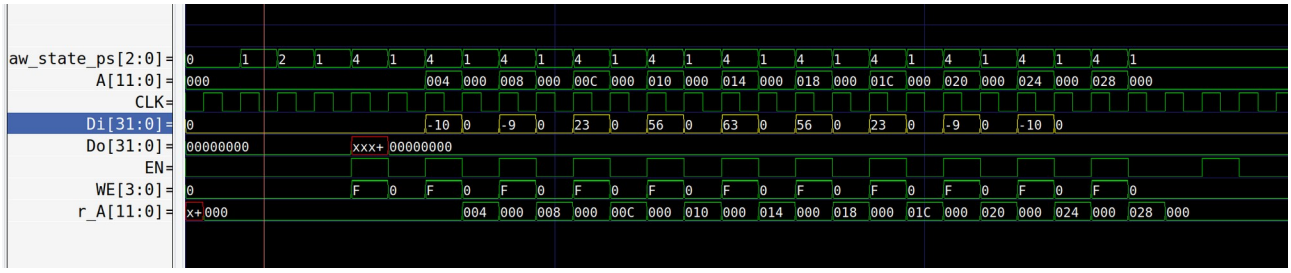
All user specified timing constraints are met.

4. Utilization report

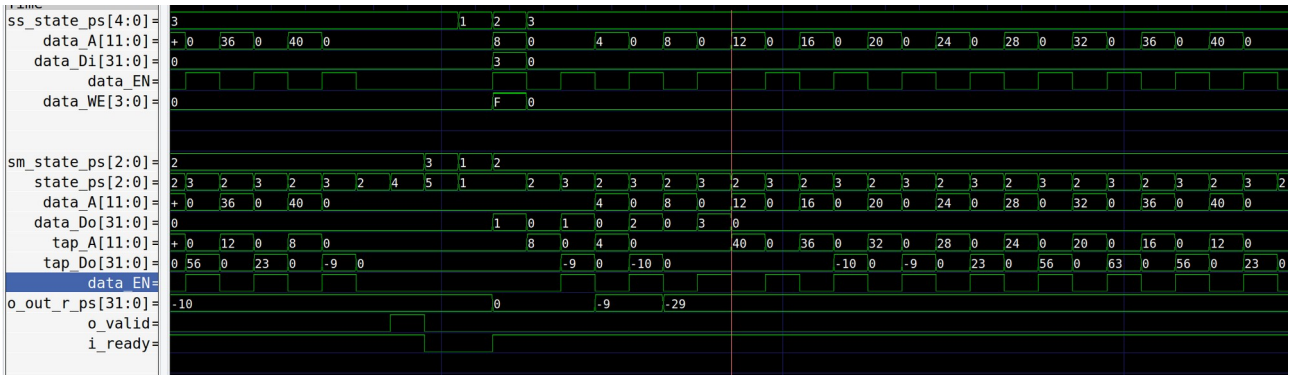
LUT: 360(0.68%)
FF: 142(0.13%)
DSP: 3 (1.36%)

5. Waveform:

(1). Coefficient write & RAM control:



(2). Xin(AXI Stream slave), Yout(AXI Stream master)



(3). ap_start: