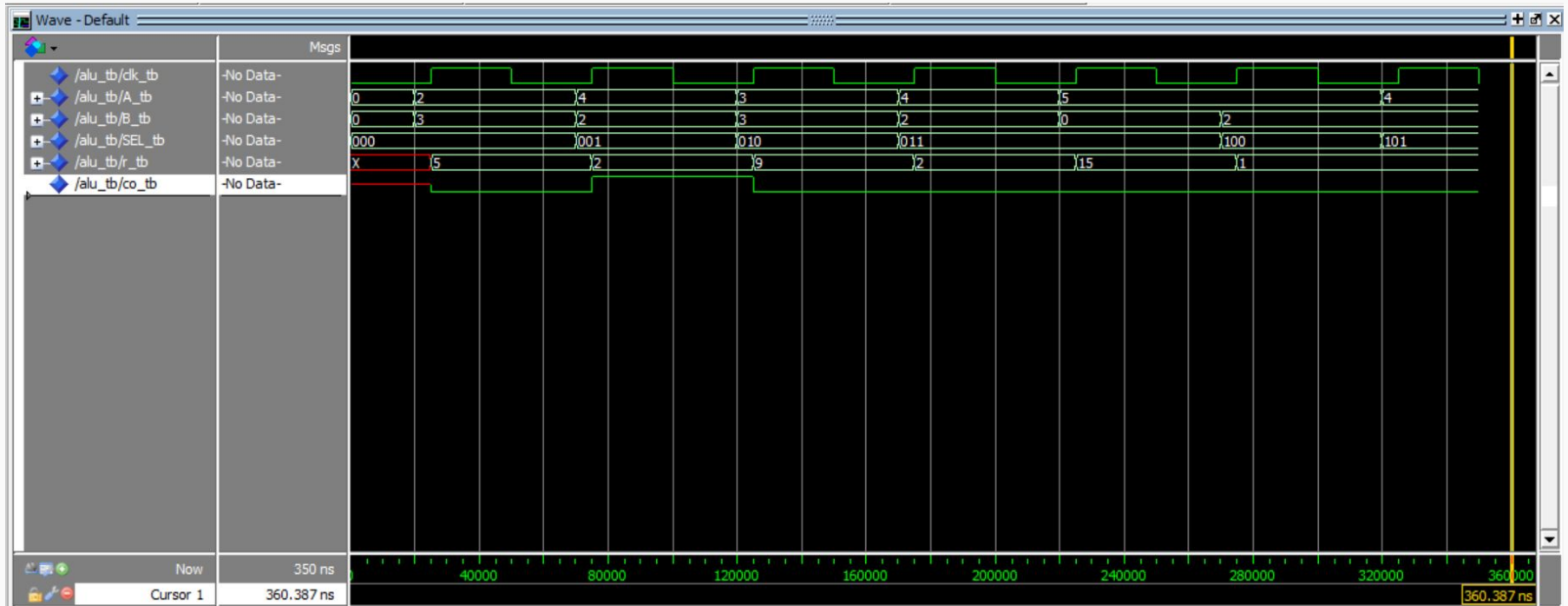


Arithmetic Logic Unit (ALU)

Proyecto Final de *Circuitos Lógicos Programables*

- **Profesor:** Nicolás Alvarez
- **Alumno:** Agustin Vazquez

ALU de 4 bits



ALU de 4 bits

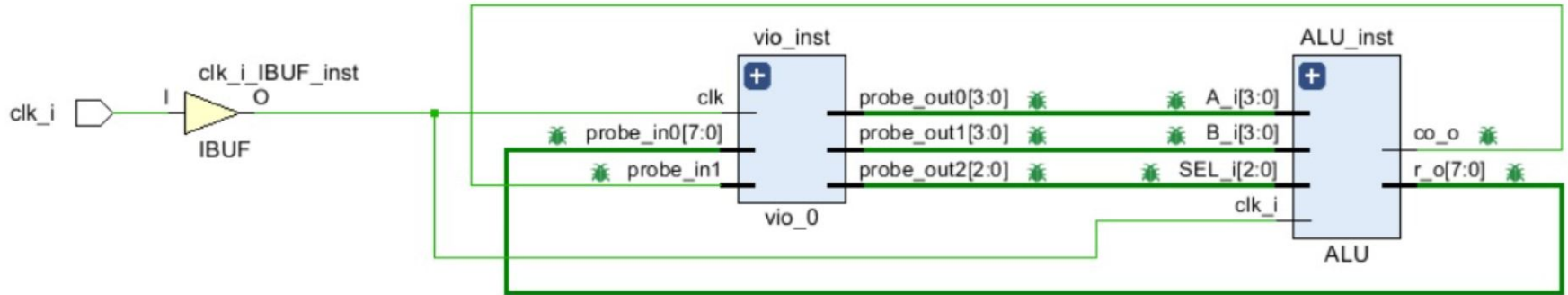


Tabla de operaciones de la ALU

ALU_Sel	Operación	Resultado
000	Suma	$A + B$
001	Resta	$A - B$
010	Multiplicación	$A * B$
011	División	A / B
100	Módulo	$A \% B$
101	Desplazamiento	$A \gg B$

Simulación Modelsim

Operación: suma

The screenshot displays the Modelsim simulation environment. At the top, the 'Wave - Default' window shows a list of variables on the left and a 'Msgs' pane in the center. The waveform area on the right shows signals 3, 4, 7, and 15, with values 12 and 15 visible. Below the waveforms, two 'hw_vios' windows are shown, each containing a table of variables and their values.

Wave - Default

Msgs

3
4
7
15

12
15
0

hw_vios

hw_vio_1

Name	Value	Activity	Direction	VIO
> A_[3:0]	[H] 5		Output	hw_vio_1
> B_[3:0]	[H] 2		Output	hw_vio_1
int_co	[B] 0		Input	hw_vio_1
> int_r[7:0]	[H] 07		Input	hw_vio_1
> SEL_[2:0]	[H] 0		Output	hw_vio_1

hw_vios

hw_vio_1

Name	Value	Activity	Direction	VIO
> A_[3:0]	[H] E		Output	hw_vio_1
> B_[3:0]	[H] 3		Output	hw_vio_1
int_co	[B] 1		Input	hw_vio_1
> int_r[7:0]	[H] 01		Input	hw_vio_1
> SEL_[2:0]	[H] 0		Output	hw_vio_1

Simulación Modelsim

Operación: resta

Wave - Default

	Msgs
/sub4b_tb/a_tb	-No Data-
/sub4b_tb/b_tb	-No Data-
/sub4b_tb/d_tb	-No Data-
/sub4b_tb/p_tb	-No Data-

5					0					7
3					1					7
2					-1					0

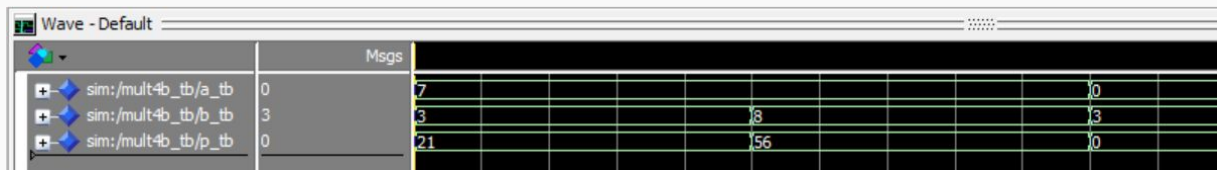
hw_vios

hw_vio_1

Name	Value	Activity	Direction	VIO
> A_[3:0]	[H] 5		Output	hw_vio_1
> B_[3:0]	[H] 2		Output	hw_vio_1
int_co	[B] 1		Input	hw_vio_1
> int_[7:0]	[H] 03		Input	hw_vio_1
> SEL_[2:0]	[H] 1		Output	hw_vio_1

Simulación Modelsim

Operación: **multiplicación**

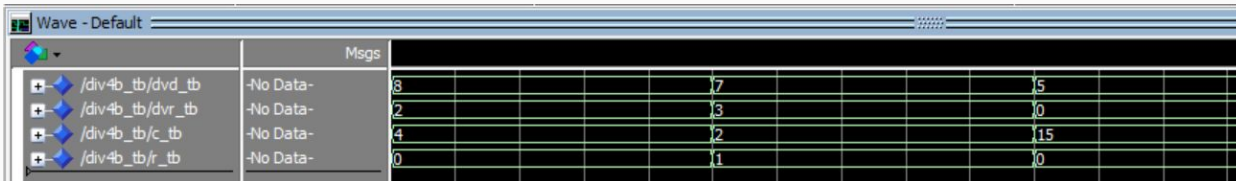


The screenshot shows the 'hw_vios' window with the following I/O configuration table:

Name	Value	Activity	Direction	VIO
> A_i[3:0]	[H] 5		Output	hw_vio_1
> B_i[3:0]	[H] 2		Output	hw_vio_1
int_co	[B] 0		Input	hw_vio_1
> int_r[7:0]	[H] 0A		Input	hw_vio_1
> SEL_i[2:0]	[H] 2		Output	hw_vio_1

Simulación Modelsim

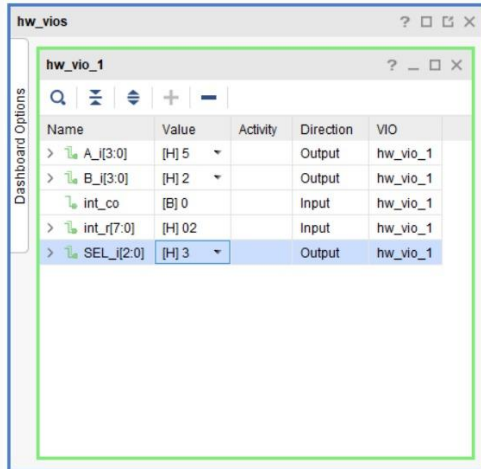
Operación: división y módulo



Wave - Default

	Msgs
/div4b_tb/dvd_tb	-No Data-
/div4b_tb/dvr_tb	-No Data-
/div4b_tb/c_tb	-No Data-
/div4b_tb/r_tb	-No Data-

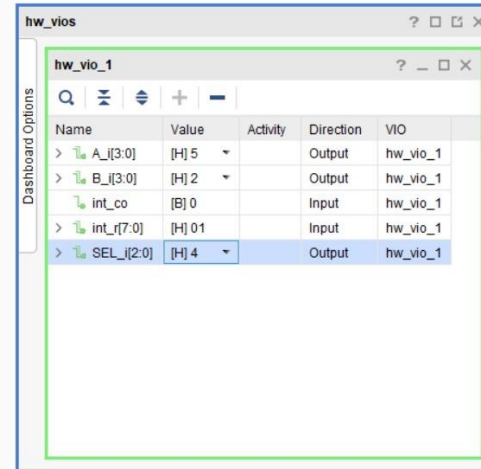
8	7	5
2	3	0
4	2	15
0	1	0



hw_vios

hw_vio_1

Name	Value	Activity	Direction	VIO
> A_[3:0]	[H] 5		Output	hw_vio_1
> B_[3:0]	[H] 2		Output	hw_vio_1
int_co	[B] 0		Input	hw_vio_1
> int_r[7:0]	[H] 02		Input	hw_vio_1
> SEL_[2:0]	[H] 3		Output	hw_vio_1



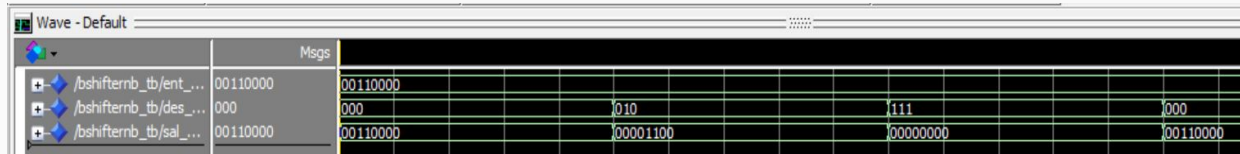
hw_vios

hw_vio_1

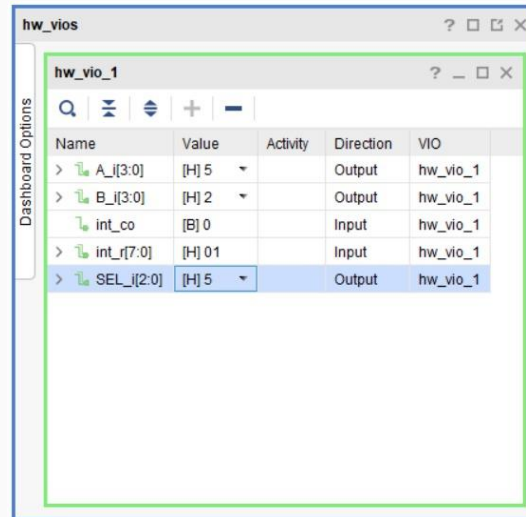
Name	Value	Activity	Direction	VIO
> A_[3:0]	[H] 5		Output	hw_vio_1
> B_[3:0]	[H] 2		Output	hw_vio_1
int_co	[B] 0		Input	hw_vio_1
> int_r[7:0]	[H] 01		Input	hw_vio_1
> SEL_[2:0]	[H] 4		Output	hw_vio_1

Simulación Modelsim

Operación: desplazamiento



Signal	Value
/bshifternb_tb/ent_...	00110000
/bshifternb_tb/des_...	000
/bshifternb_tb/sal_...	00110000



Name	Value	Activity	Direction	VIO
> A_([3:0])	[H] 5		Output	hw_vio_1
> B_([3:0])	[H] 2		Output	hw_vio_1
> int_co	[B] 0		Input	hw_vio_1
> int_r([7:0])	[H] 01		Input	hw_vio_1
> SEL_([2:0])	[H] 5		Output	hw_vio_1