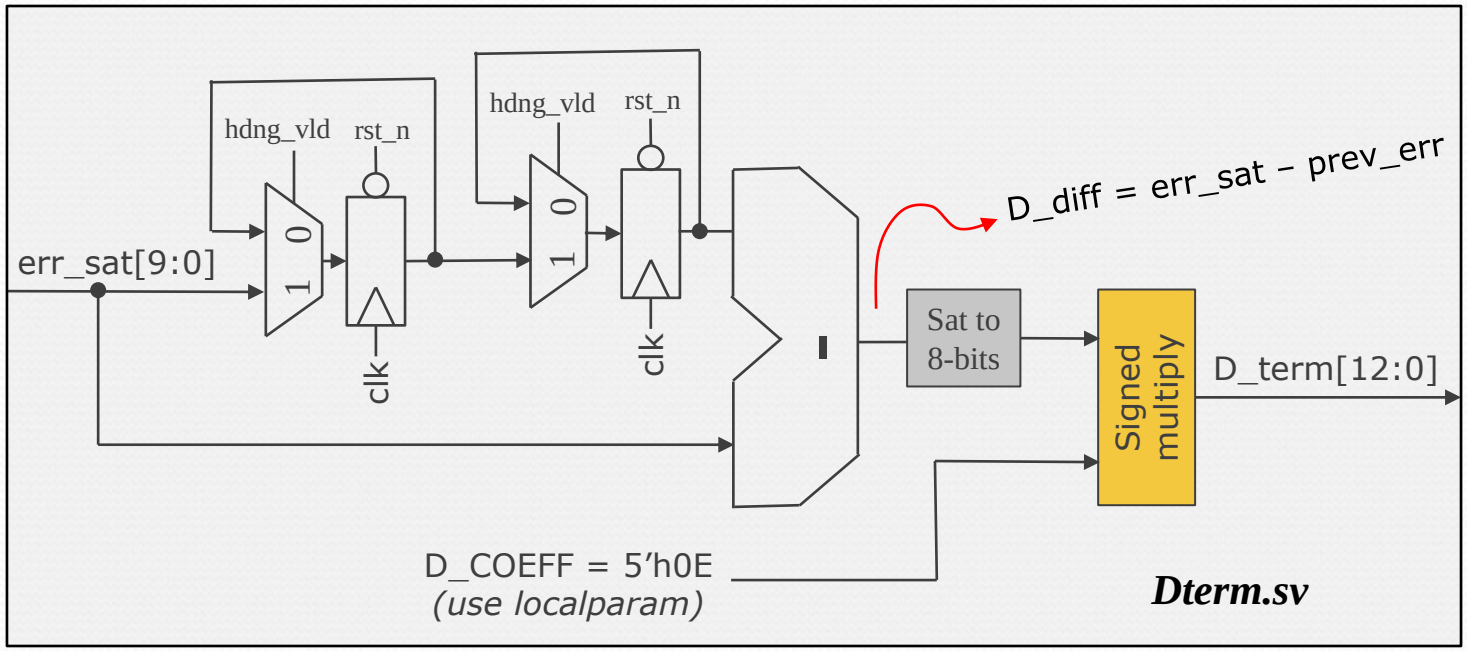
Exercise 11 (D_term and assembly of PID) (HW3 prob 5):

The derivative of a function can be approximated by: $\frac{dF(t)}{dt} = \frac{f(t)-f(t-\Delta t)}{\Delta t}$

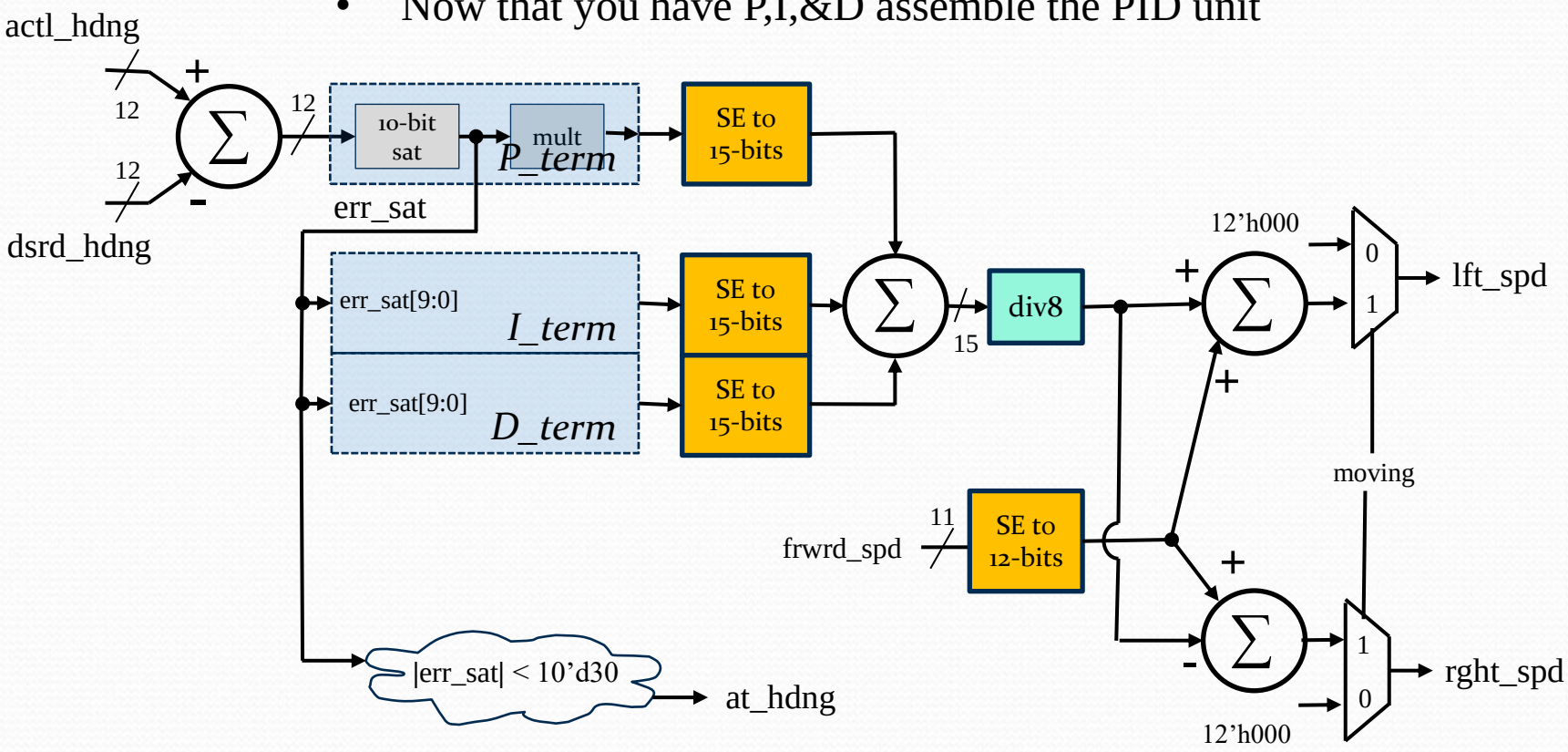
We only need something proportional to the derivative so the divide by Δt is unnecessary. Consider the following circuit:



Testbench should be self-checking…so you will have to do some calculations on the side.
Submit: Dterm.sv, **Dterm_tb.sv**, and proof it ran.

Exercise 11 (assembly of PID) (HW3 prob 5):

- Now that you have P,I,&D assemble the PID unit



- **NOTE:** The blocks ***P_term***, ***I_term***, & ***D_term*** are shown outlined in dotted lines because you may not want to instantiate them, but rather copy their implementation in flat into **PID.sv.**

Exercise 11 (assembly of PID) (HW3 prob 5):

Signal:	Dir:	Description:
clk, rst_n	in	50MHz clock and asynch active low reset
moving	in	High if turning or moving forward *(from navigate block)*
dsrd_hdng[11:0]	In	Signed desired heading *(from cmd_proc)*
actl_hdng[11:0]	in	Signed actual heading *(from inert_intf)*
hdng_vld	In	High for 1 clock every new valid gyro reading
frwrd_spd[10:0]	In	Unsigned forward speed *(from navigate block)*
at_hdng	out	Asserted if error is small
lft_spd[11:0]	out	Signed left motor speed *(goes to MtrDrv)*
Rght_spd[11:0]	out	Signed right motor speed

- Produce **PID.sv**
- A basic self-checking testbench is provided (**PID_tb.sv**).
- Submit your code and an image of the transcript window showing is passes the provided testbench