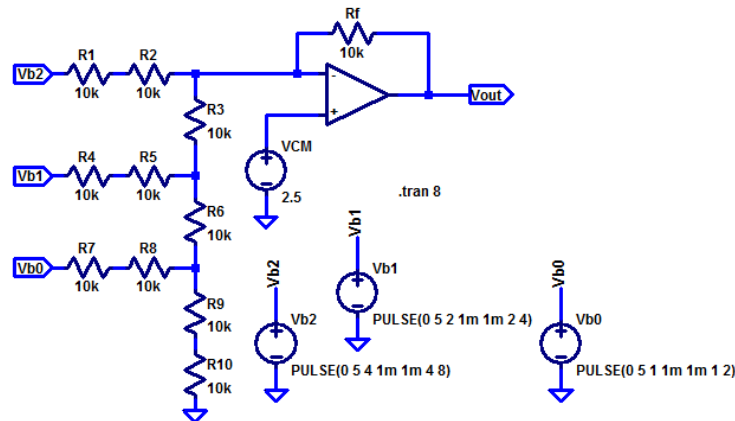
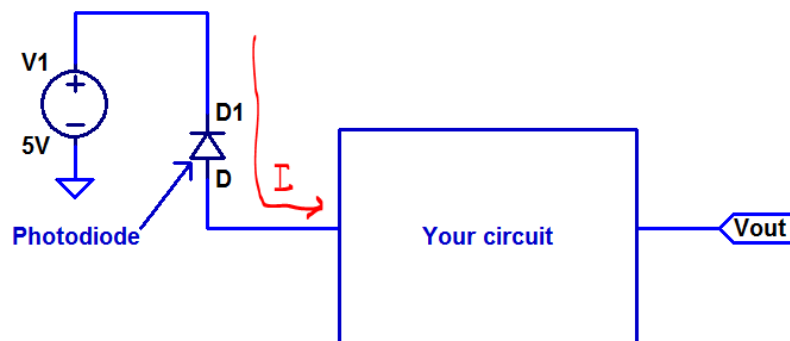


Show your work for credit!

- Find an equation for V_{out} in terms of V_{b0} , V_{b1} , and V_{b2} . Pick values for these later voltages and show, using hand calculations and a simulation, that your equation is correct. Please don't focus on, or get confused by, the values I picked for V_{b0} , V_{b1} , or V_{b2} below when I simulated. You pick a DC value for these in this problem. (6 points)



- An infrared (light at longer wavelengths than the visible spectrum so you can't see it) light-emitting diode (LED) may be used in a remote control to send infrared light to the TV, game console, cable box, etc. to control operation. In these receiving devices there is a photodiode, a device that converts the received light into current. Modeling the diode below as a current source that may vary from 0 to 1 μA in the direction shown, design, using a single ideal op-amp and single resistor, a circuit that converts this current to a voltage that varies from 0 to -1 V (0 input current then 0 V output voltage, 1 μA input current then -1 V output, 0.5 μA input then -500 mV output). Simulate, using a DC sweep of the input current, the operation of your circuit. The circuit you design is often called a transresistance, or transimpedance amplifier, since its output is voltage and its input is current ($V_{oltage}/Curren\text{t} = R\text{esistance}$). (3 points)



- Re-design the circuit in problem 2 so that the output varies from -1 V to -2 V, that is, an input of 0 μA gives -1 V output while an input of 1 μA gives an output of -2 V. Note that you can accomplish this design using the design in problem 2 with an added voltage source (only). Simulate your design as done in problem 2. (2 points)