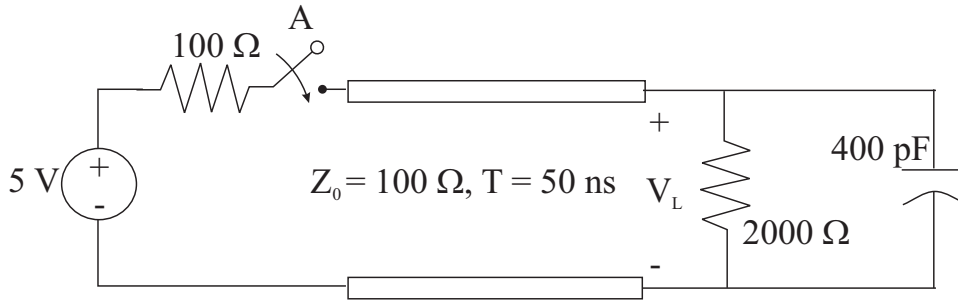


ECE 3025 Homework 4: Reactive and Nonlinear Loads

1. Two logic gates are connected by a transmission line with the following circuit parameters:

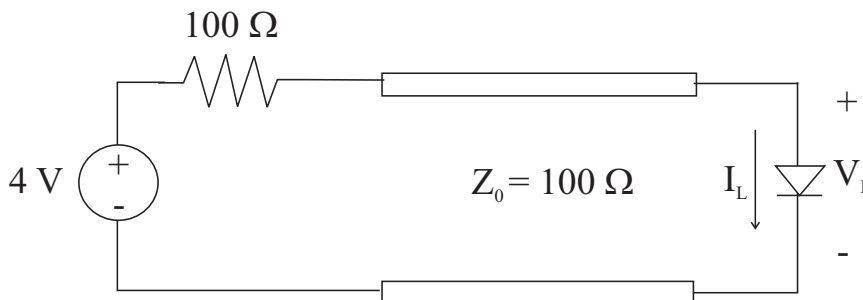


Note that the logic gate being driven by the transmission line has 400 pF of parasitic capacitance. If a short logic pulse is sent down the line by closing switch A for a period of 30ns, answer the following questions:

- (a) Sketch the output $V_L(t)$ for $t \geq 0$ s, clearly labeling all voltage levels and times. (3 points)
 - (b) If the logic pulse will not trigger a gate until a threshold of 2.5 V is exceeded at its input terminals, what is the total triggering latency (as measured from the origin of the pulse at $t = 0$) for this transmission line. (2 points)
2. Below is a transmission line that drives a simple diode with the following V-I characteristic:

$$V_L = V_0 \ln \left(\frac{I_L}{I_0} + 1 \right)$$

where $V_0 = 0.4$ V and $I_0 = 0.5$ mA.



- (a) Find the steady state load voltage and current. (3 points)
- (b) Calculate the steady-state reflected voltage on the line. (2 points)
- (c) Now reverse the diode at the end of the line and find the new steady state load voltage and current. (3 points)
- (d) Calculate the steady-state reflected voltage on the line. (2 points)
3. Below is a chaotic transmission line circuit where R_s can take on any value greater than -32.5Ω . Find a source resistance value that leads to an output that oscillates between 3 distinct values. Plot the output.

