Electromagnetic Fields – Tutorial 03 & Assignment 03

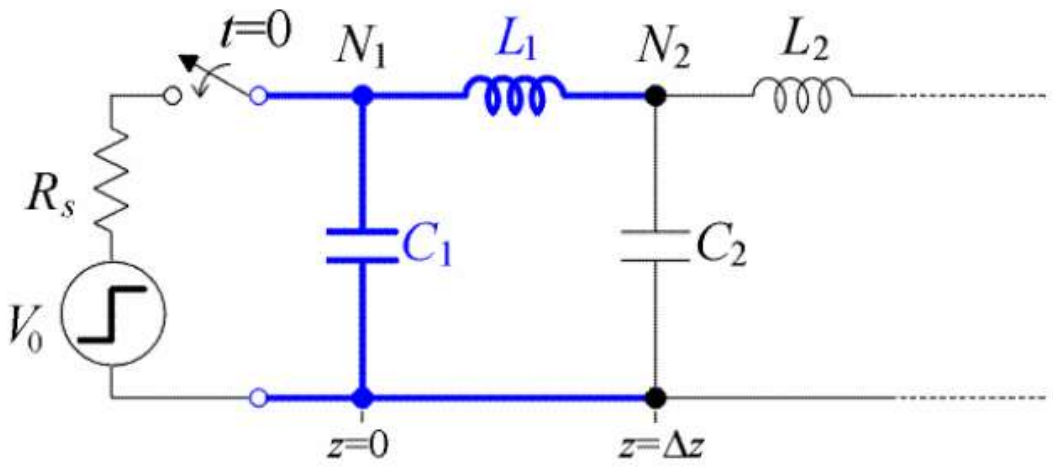
Transmission Lines Fundamentals

#	Student ID	Student Name	Grade (10)
-			

Delivery Date	

١. يتم تسليم التمرين محلولا في خلال أسبوع من تاريخ التمرين، و يتم حذف درجتين من التمرين عن كل أسبوع تأخير
٢. يتم التسليم لمعيد المقرر مباشرة
٣. تتم أجابه التمرين في نفس ورق الأسئلة

Q1



Circuit model of transmission line.

Consider the distributed circuit model of a lossless transmission line shown in Fig.

Assume the line is initially at rest, i.e. $v(z,0^-)=0$ (zero voltage for any node N_i at $t=0^-$), $i(z,0^-)=0$ (zero current for any branch at $t=0^-$).

Part 1

What is the voltage of node N_1 at $t = 0^+$, i.e. $v(0,0^+)$? What is the current along L_1 at $t = 0^+$, i.e. $i(0,0^+)$? Justify your answers. (*Hint*: Capacitor current: $i = C \cdot \frac{d}{dt} v$, inductor voltage: $v = L \cdot \frac{d}{dt} i$.)

A voltage change across the capacitor

$$i = C \cdot \frac{d}{dt} v$$

Instantaneous voltage change will cause an infinite current,
So Switch on the moment, the potential across the capacitor is in the same state, that is N1 in t=0+, voltage V(0,0+)=0
Similarly, the voltage across the inductor change takes time, otherwise it will create infinite voltage. Therefore, t=0+ flow through L1. Current i(0,0+)=0

Part 2	What is the current along C_1 at $t = 0^+$? What is the voltage of node N_2 at $t = 0^+$, i.e. $v(\Delta z, 0^+)$? (*Hint*: Borrow the result of Problem a.)

At the moment the switch pressed down, the output voltage electron source will first hole to do across the capacitor charge, then you can
As access to the first capacitor. Therefore, the flow in the current through the wire and the capacitor will be

$$Ic = \frac{V0}{Rs}$$

According to

$$v = L\frac{di}{dt}$$

the inductor current change will not be instantaneous change, rising from scratch.

So both ends of the inductor L1 at t=0+, not have a voltage difference, the voltage on the N2 is zero.

Part 3	Describe how do node voltages at N_1, N_2, …, and branch currents along inductors L_1, L_2, … change with time ($t > 0^+$)? Justify the "wave" behavior accordingly.

When the switch is on, the voltage source through a resistor Rs capacitor C1 is charged, so that the voltage V1 N1 gradually rises.
Before charging capacitor C1, inductor L1 no current flows. After capacitor charging, V1 rises, the inductance
L1 voltage appears across difference, stay off the inductor current I1 gradually increased.
When current flows through L1, the capacitor C2 can be charged, and so on, will gradually transfer the energy down.
But regardless of capacitance or inductance will take some time to change the voltage across or current. Therefore, the energy transfer must
After a time difference. Therefore, the voltage change in the voltage of N1 and N2, there will be a time difference, so the voltage of N2
And voltage variations N3 will have the time difference. And after the current through L1, it takes some time before through the inductor
L2, back through the inductor current situation and so on.
In the lossless transmission line, assuming the capacitance and inductance values each segment are the same as the equivalent circuit, the voltage and
The current will pass along a particular speed.

Described above can be found in accordance with the transmission line voltage and current having wave characteristics.
Because the values of voltage and current with the changing time and location, and continue to pass along the + z direction.