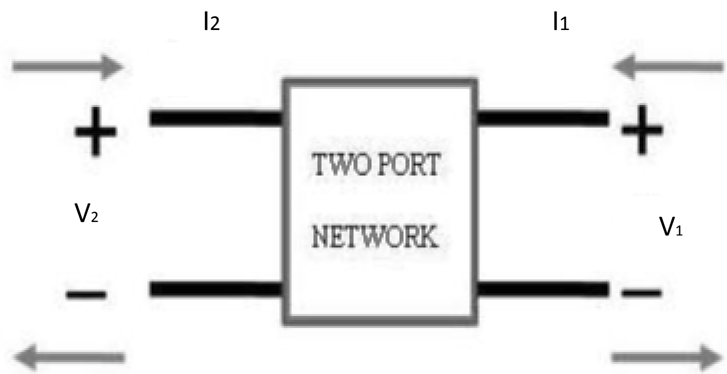
EXPERIMENT-4

IMPEDENCE (Z) -PARAMETER

PROBLEM STATEMENT: To study the Z-parameters

THEORY:



If a network has two pairs of terminals, one pair for connections to a source and one pair for connections to a load, the network is known as a two port network.

In many practical situations, we may not be interested in the internal structure of the network but we are satisfied with its behavior at the given set of terminals

A pair of terminals at which a signal may enter or leave a network is called a port.

If we choose I_1 and I_2 as independent variables and V_1 and V_2 as dependent variables. Then the network can be characterized by following sets of equations.

$$V_1=Z_{11} * I_1 + Z_{12} * I_2$$

$$V_2=Z_{21} * I_1 + Z_{22} * I_2$$

Observe that if either $I_1=0$ or $I_2= 0$ the four parameters may be defined in terms of ratio of a voltage and current.

$Z_{11}=V_1/I_1$ when $I_2=0$ $\qquad$ $Z_{12}=V_1/I_2$ when $I_1=0$

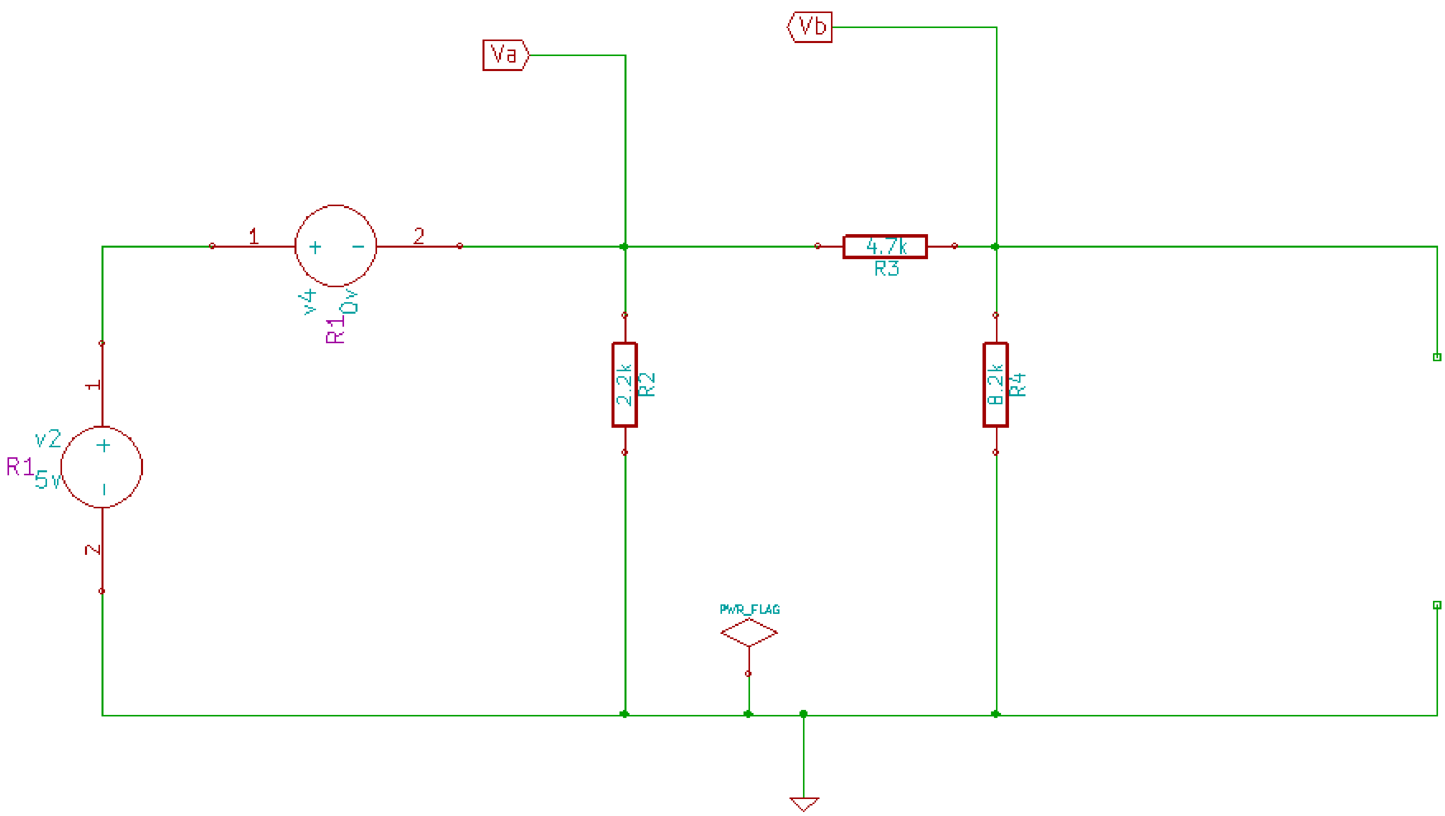
$Z_{21}=V_2/I_1$ when $I_2=0$ $\qquad$ $Z_{22}=V_2/I_2$ when $I_1=0$

In this experiment the focus is on finding the Z- parameters. The individual Z-parameters are added to determine the overall Z- parameters for any number of networks connected in series- series connection.

Two port networks are useful as they form the building block of commonly used electrical systems like filters, attenuators, transmission lines which are inserted between a source and a load. It is easier to design a simple block and then interconnecting them than to design a single complex network.

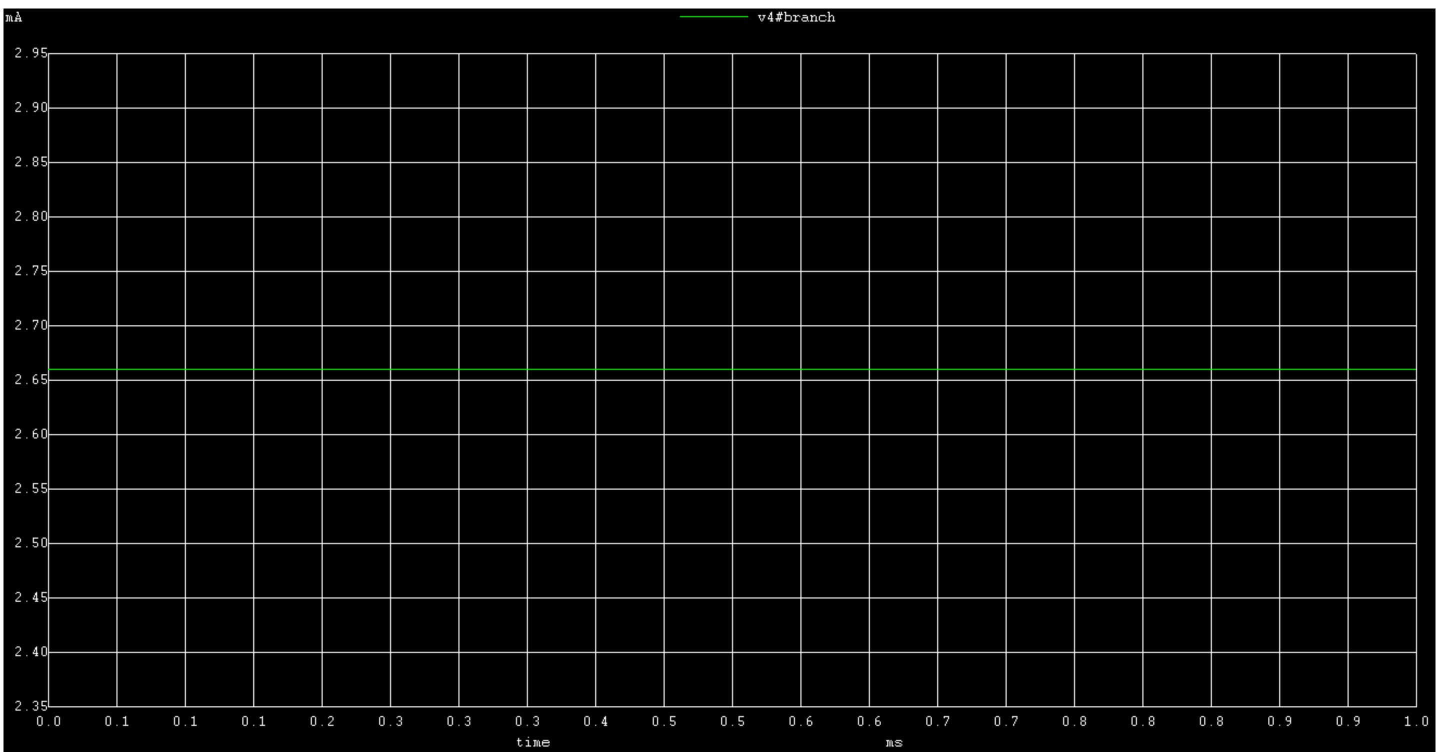
SCHEMETIC DIAGRAM:

For I_1=0 Refer to "parameters" FOLDER

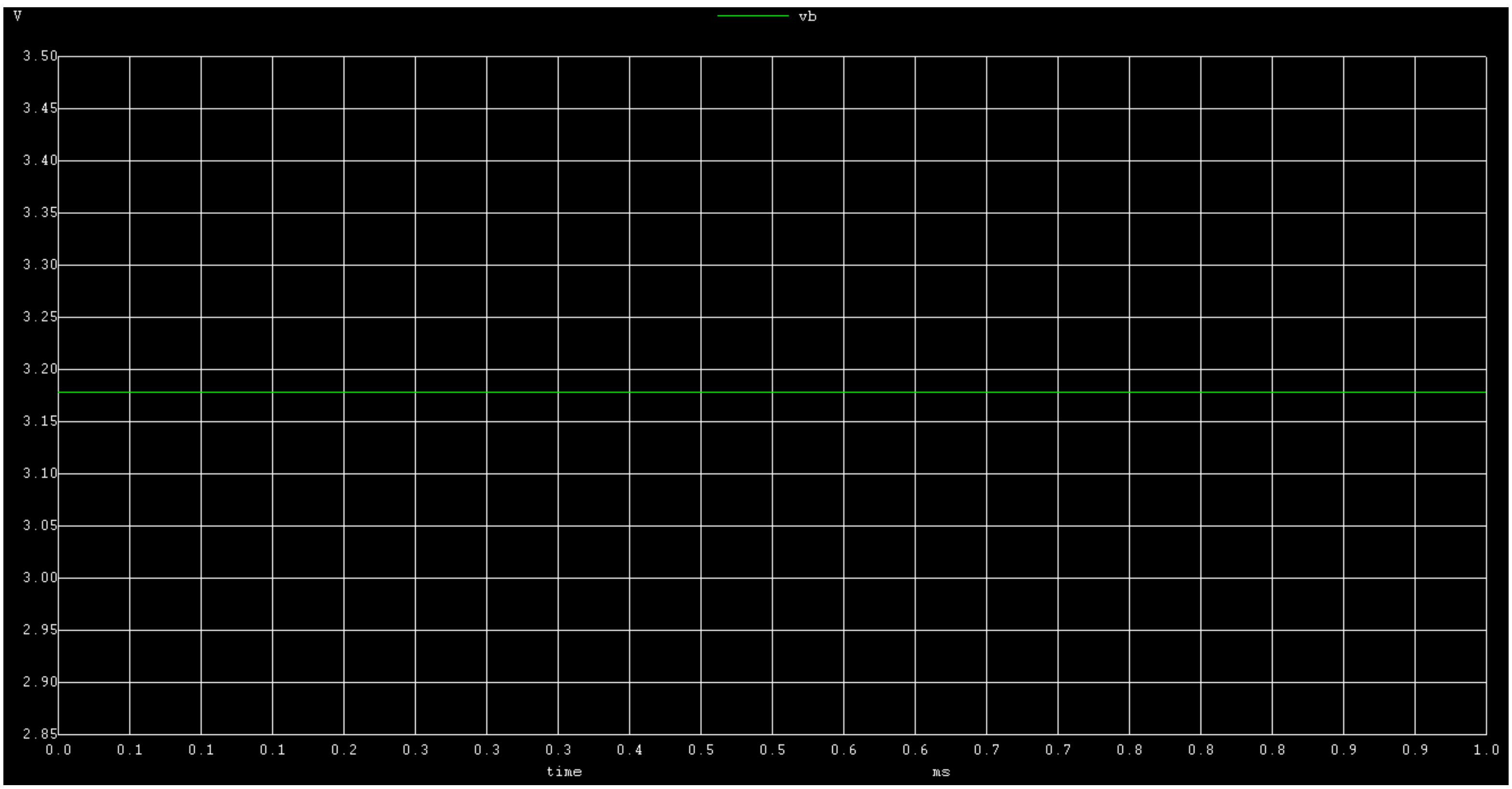


SIMULATION OUTPUT:

Value of I_2

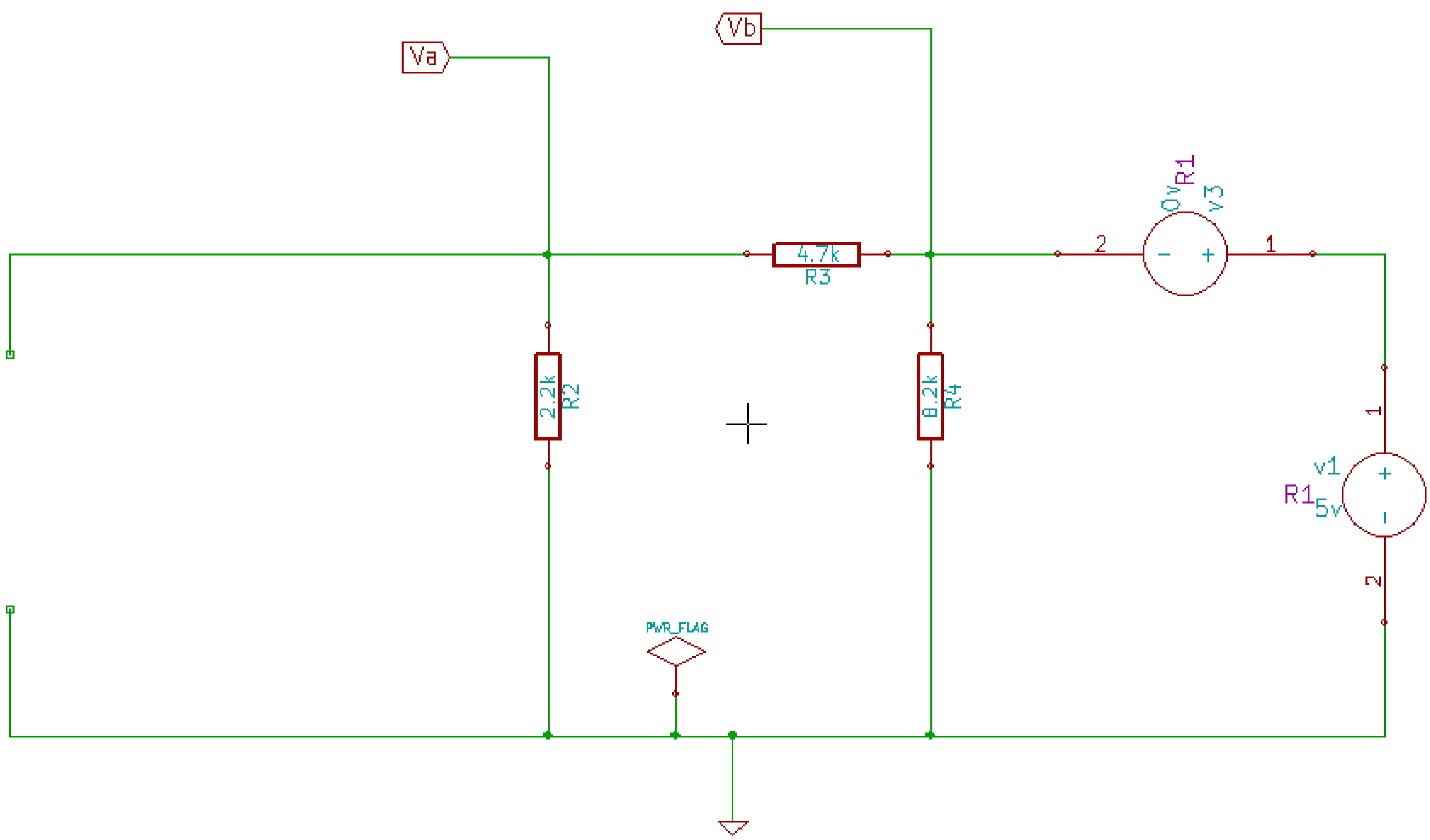


Value of V_b (V_1):



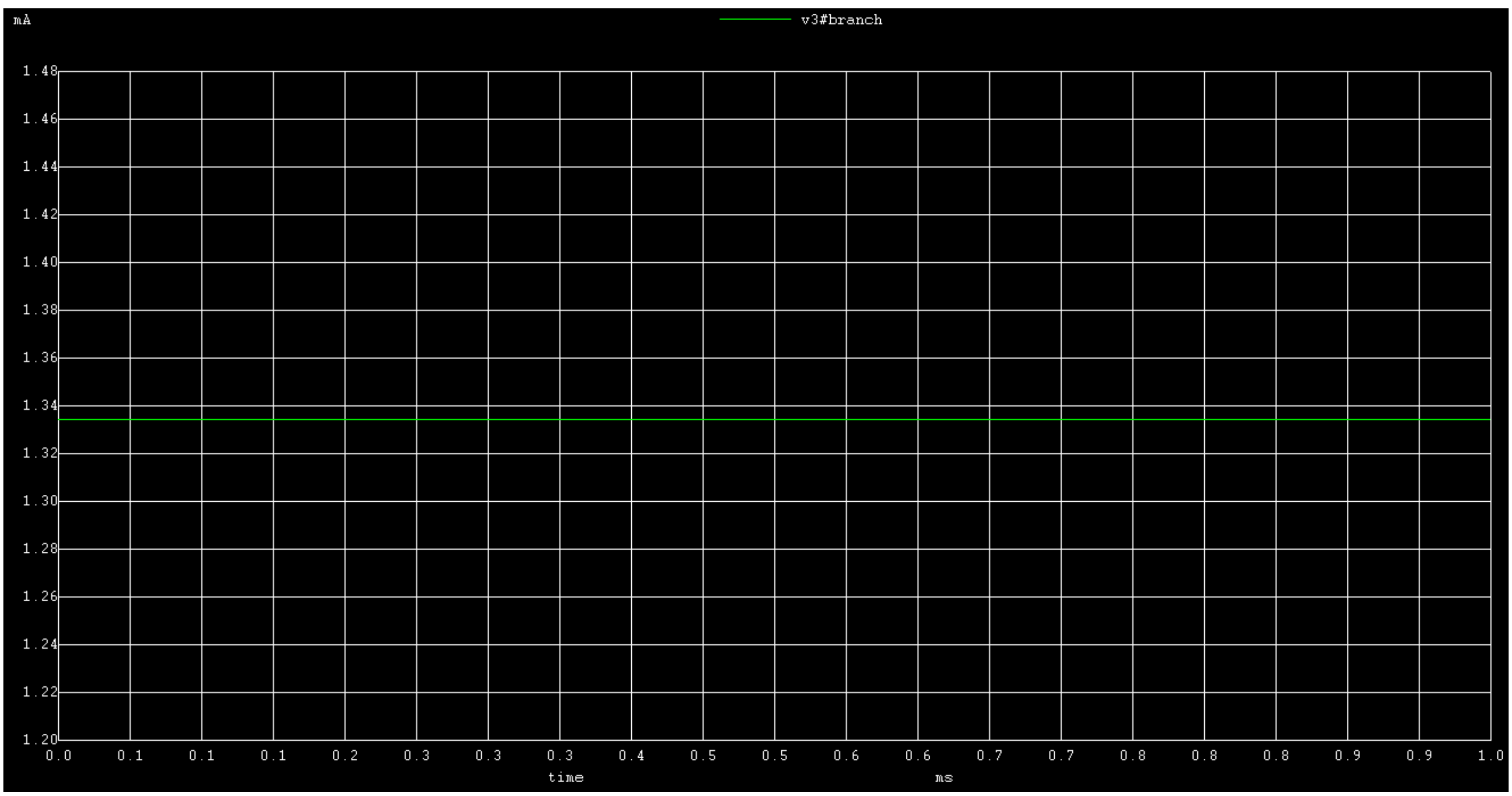
SCHEMATIC DIAGRAM:

For I_2=0 Refer to "parameters1" FOLDER

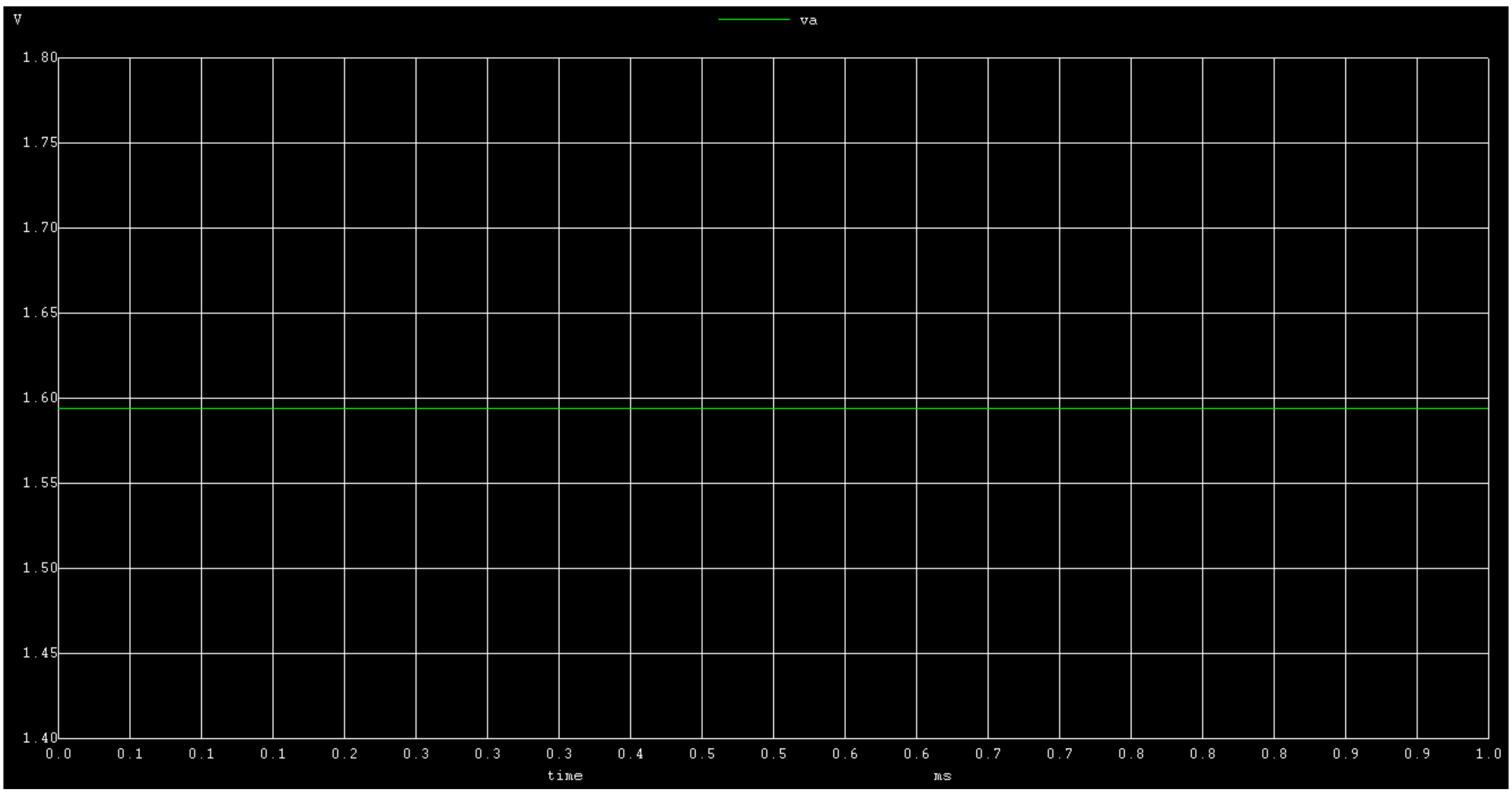


SIMULATION OUTPUT:

Value of I_1



Value of V_a (V_2):



CALCULATIONS:

$Z_{11}=V_1/I_1$ when $I_2=0mA$

$I_1=1.337mA$, $V_1=5volts$

So, $Z_{11}= 5/1.337 = 3.74k\Omega$

$Z_{21}=V_2/I_1$ when $I_2=0mA$

$I_1=1.337mA$, $V_2=1.556volts$

So, $Z_{21} = 1.556/1.337 =1.164k\Omega$

$Z_{22}=V_2/I_2$ when $I_1=0mA$

$I_2=2.64mA$, $V_2=5volts$

So, $Z_{22}= 5/2.64 = 1.89k\Omega$

$Z_{12}=V_1/I_2$ when $I_1=0mA$

$I_2=2.64mA$, $V_1=1.556volts$

So, $Z_{12} = 1.556/2.64 = 0.59k\Omega$

Z_{11} (kΩ)	Z_{12} (kΩ)	Z_{21} (kΩ)	Z_{22} (kΩ)
3.74	1.89	1.164	0.59

CONCLUSION: