Department of Electrical and Computer Engineering

University of Victoria

ELEC 300 - Linear Circuits II

Laboratory Report

Experiment No.:	4
Title:	Analysis and Applications of Active Networks
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1 Objective

This experiment will use active, first order circuits to explore s-domain network analysis.

2 Introduction

The Laplace transform, $X(s) = \mathscr{L}\{x(t)\}$, simplifies the analysis of complex networks by replacing network elements with their equivalent impedances. Integro-differential operations in the time-domain become algebraic operations in the Laplace s-domain.

A first order network with an active element can be generalized by the model shown in Fig. 1.

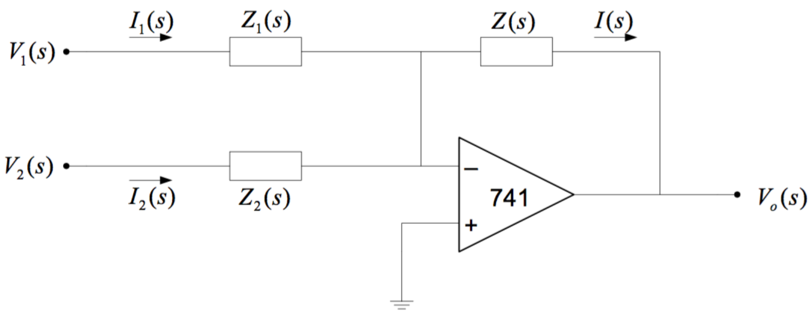

Figure 1: First order network in the s-domain

In the s-domain, the output is

$$V_o = -\left[\frac{Z}{Z_1}V_1 + \frac{Z}{Z_2}V_2\right] \tag{1}$$

This general configuration gives rise to many different circuits depending on the values of Z, Z_1 and Z_2.

Inverting Voltage Amplifier $Z = R$, $Z_1 = R_1$, $Z_2 = \infty$

$$V_o = -\frac{R}{R_1}V_1 \tag{2}$$

Inverting Adder $Z = R$, $Z_1 = R_1$, $Z_2 = R_2$

$$V_o = -\left[\frac{R}{R_1}V_1 + \frac{R}{R_2}V_2\right] \tag{3}$$

Inverting Integrator $Z = \frac{1}{sC}$, $Z_1 = R_1$, $Z_2 = \infty$

$$V_o = -\frac{1}{R_1 C} \cdot \frac{1}{s} V_1 = -G_1 \frac{1}{s} V_1 \tag{4}$$

In the time domain this becomes

$$v_o(t) = -G_1 \int_0^t v_1(\tau) d\tau.$$

Inverting Integrator $Z = \frac{1}{sC}$, $Z_1 = R_1$, $Z_2 = R_2$

$$V_o = -\frac{1}{s} \left[\frac{1}{R_1 C} V_1 + \frac{1}{R_2 C} V_2 \right] \tag{5}$$

3 Results

Describe the apparatus and measurement technique(s). Present the data.

4 Discussion

Analysis and interpretation of data.

5 Conclusion

Justify conclusions and results.