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Electrical, Electronic and Computer Engineering

School of Engineering & Physical Sciences

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| **Time and Frequency Signal Analysis (B39SB)** |

**Matlab Lab 3**

**Laplace transform in circuit analysis**

1. Figure 1 shows an Op-Amp circuit. The values of the components are:

R1 = 1000 Ω, R2 = 200 Ω, C1 = 0.125 mF, C2 = 50 μF.



Figure 1 Diagram of an Op-Amp circuit.

At *t* = 0, a step voltage of 1 V is applied to the input terminals. The capacitors are in fully discharged state at *t* = 0.

Let *V*in(s), *V*2(s) and *V*out(s) be the Laplace transforms of *v*in(t), *v*2(t) and *v*out(t) respectively, then they satisfy the following equations.

(1)

(2)

(3)

(i) Find out the expression for *Vout*(s) using Matlab or by hand (pen and paper).

(5 mark)

(ii) Find out *v*out(*t*) using Matlab

(3 mark)

(iii) Using Matlab to plot *v*in(*t*) and *v*out(*t*) on the same graph for t between -0.5 s and 5 s. Comment on the output response.

(4 marks)

(iv) Plot the impulse response of the system

(4 mark)

(v) Obtain Bode plots for both magnitude and phase and comment on the responses.

(4 mark)