

**MIDDLE EAST TECHNICAL UNIVERSITY**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICAL ENGINEERING**

**EE 464 HOMEWORK 3**

**Compensator Design for Buck Converter**

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**GitHub Page:** https://github.com/erdemcanaz/EE464-HW3

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**Introduction**

You are required to design a 200 W full bridge isolating converter with 24 Vin and 200 Vout with 1% output voltage ripple. Switching frequency of the converter is 250kHz

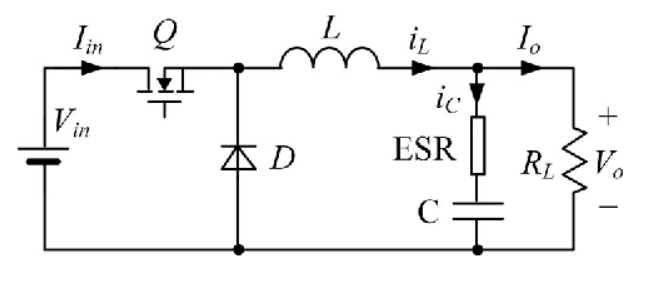
**Question 1:**

*Explain the meaning of input-to-output transfer function and control-to-output transfer function in words.*

In this context, the input-to-output transfer function refers to the relationship between the input voltage Vin and the output voltage Vout. On the other hand, the control-to-output transfer function describes the relationship between the control signal (such as the duty cycle) and the output voltage Vout.

In detail, those transfer functions are derived using small signal models at certain states. Let’s say at a certain switching frequency, the changes of the state values (i.e. inductor currents and capacitor voltages) are very small a period. Then we can utilize

Inductor voltage-second balance and capacitor current balance.



*Figure x Simple Buck Converter Topology*

For the circuit given in the Fig. X., we can write **moving average** voltage and current of the inductor and capacitor respectively as follows

Where the notation corresponds to

And and is defined as;

Then;

Now we want to **perturb** and linearize those equations. Let’s replace signals with their small signal ones. So that we can analyze the low frequency response.

|  |  |
| --- | --- |
| Original Signal | Small signal counterpart (DC + SS) |
|  |  |
|  |  |
| D(t) |  |
| D’(t) |  |
|  |  |
|  |  |

Then we can rewrite equations as;

**Introduction**