==========

For the control system shown in the figure; deduce the transfer function $E_o(s)/E_i(s)$ as function of the circuit elements.

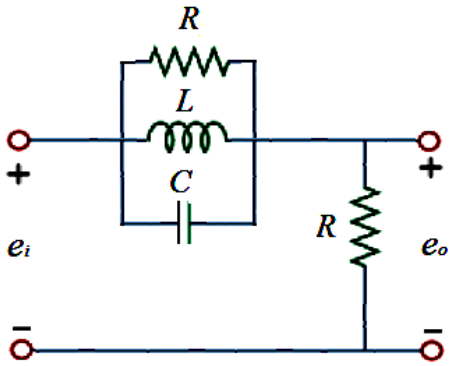

Fig. (1)

Answer

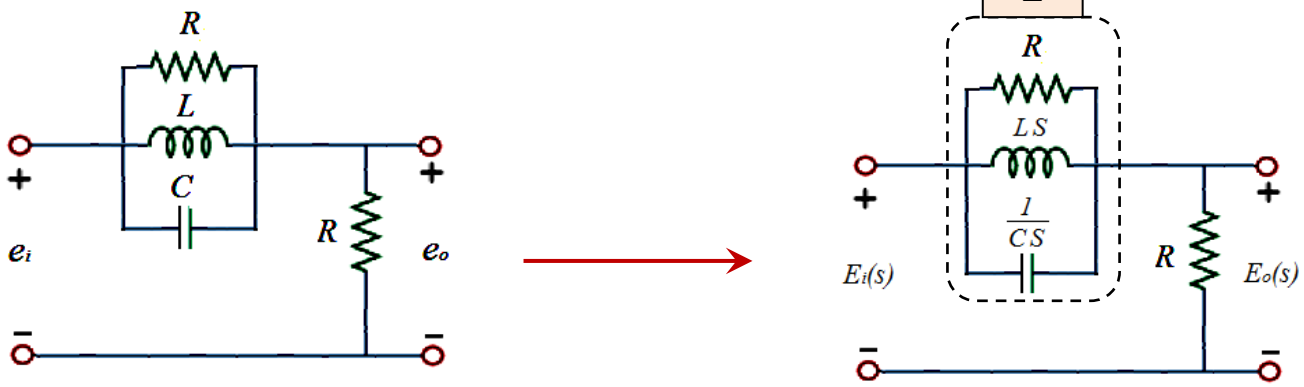

Fig. (1) circuit in t- domain

Fig. (2) circuit in S-domain

From S-domain circuit in Fig. (2):

- Total impedance Z of the components *R // (1/CS) // LS* is as follows:

$$\frac{1}{Z}=\frac{1}{R}+\frac{1}{LS}+\frac{1}{1/CS}$$

$$Z=1/\left(\frac{1}{R}+\frac{1}{LS}+\frac{1}{1/CS}\right)=\frac{RLS}{RLCS^2+LS+R}$$

$$\frac{E_o(s)}{E_i(s)}=\frac{R}{Z+R}=\frac{R^2LCS^2+RLS+R^2}{R^2LCS^2+2RLS+R^2}$$

Note that: you can get Z by:
First …. Obtain R//LS as Z_1
Second ….. Obtain Z_1//(1/CS) as Z
Then: $Z=\dfrac{RLS}{RLCS^2+LS+R}$