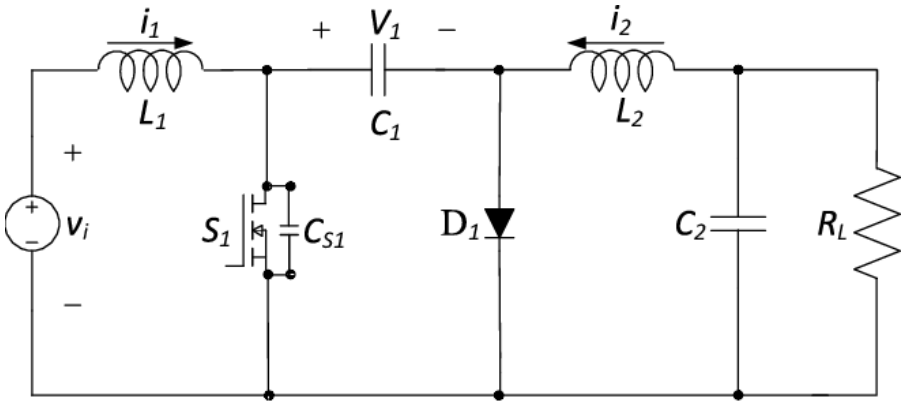
# Design of Ćuk converter




**Design parameter:**

Input Voltage ($V_{in}$) = 25V

Output Voltage required ($V_o$) = -30V

Output Resistor (R) = 15 Ohm

Switching Frequency = 50kHz

Output Power ($P_o$) = 60W

**Step 1: Determine the Duty Ratio**

$$D = \frac{Vo}{Vin + Vo} = 0.545$$

**Step 2: Determine the average inductor current and change in inductor currents**

$$I_{l2} = \frac{Po}{-Vo} = 2\ A$$

$$I_{l1} = \frac{Pin}{Vin} = \frac{(Vin)^2 R}{Vin} = 1.66\ A$$

The change in inductor current is given by (assuming 20% changes in ripple current)

$$\Delta I_{l1} = 0.2 \times\ 1.66\ = 0.332\ A$$

$$\Delta I_{l2} = 0.2 \times\ 2\ = 0.4\ A$$

**Step 3: Determine Inductor Size**

$$\Delta i_l = \frac{VinD}{Lf}$$

From the above equation we can calculate inductance values as:

$$L_1 = \frac{VinD}{\Delta i_{l1} f} = 820uH$$

$$L_2 = \frac{VinD}{\Delta i_{l2} f} = 681uH$$

**Step 4: Determine Capacitor size**

(Assuming 1% ripple)

$$C_2 = \frac{1 - D}{8L_2 \left(\frac{\Delta Vo}{Vo}\right) f^2} = 3.33uF$$

Average voltage across $C_1$ $is$ $25 - (-30) \ = \ 55V$

Maximum change in $V_{C_1} = \ 55 \times 0.05V \ = \ 2.75V$ (Assuming ripple for $C_1$ as 5%)

$$C_1 = \frac{VinD}{Rf\Delta V_{c1}} = 7.92uF$$

Choose $C_1 = 8uF$ and $C_2$ $as$ $3.5uF$