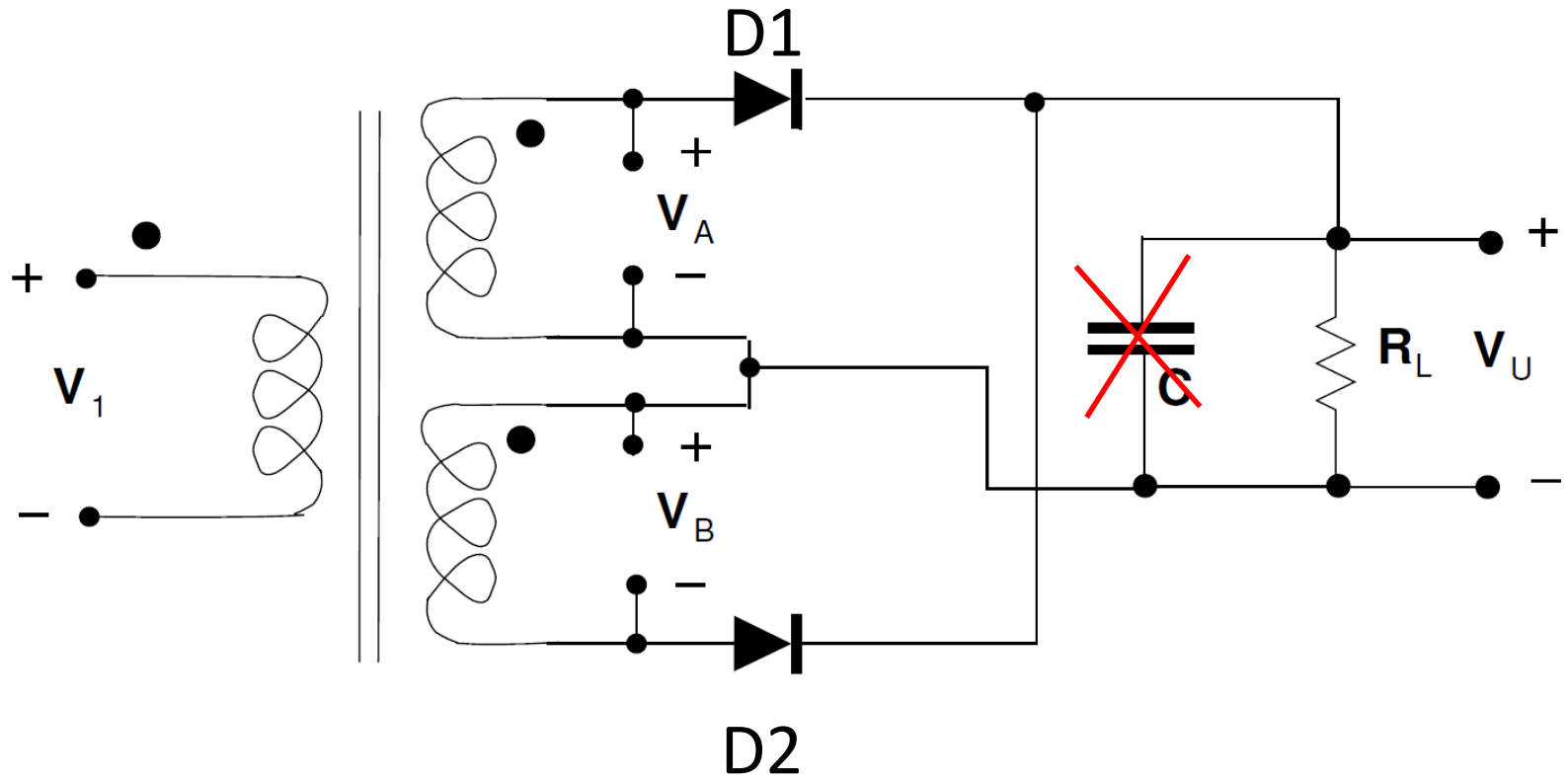
Elettronica Digitale
A.A. 2020-2021

Lezione 15/03/2021

Raddrizzatori a doppia semionda senza C

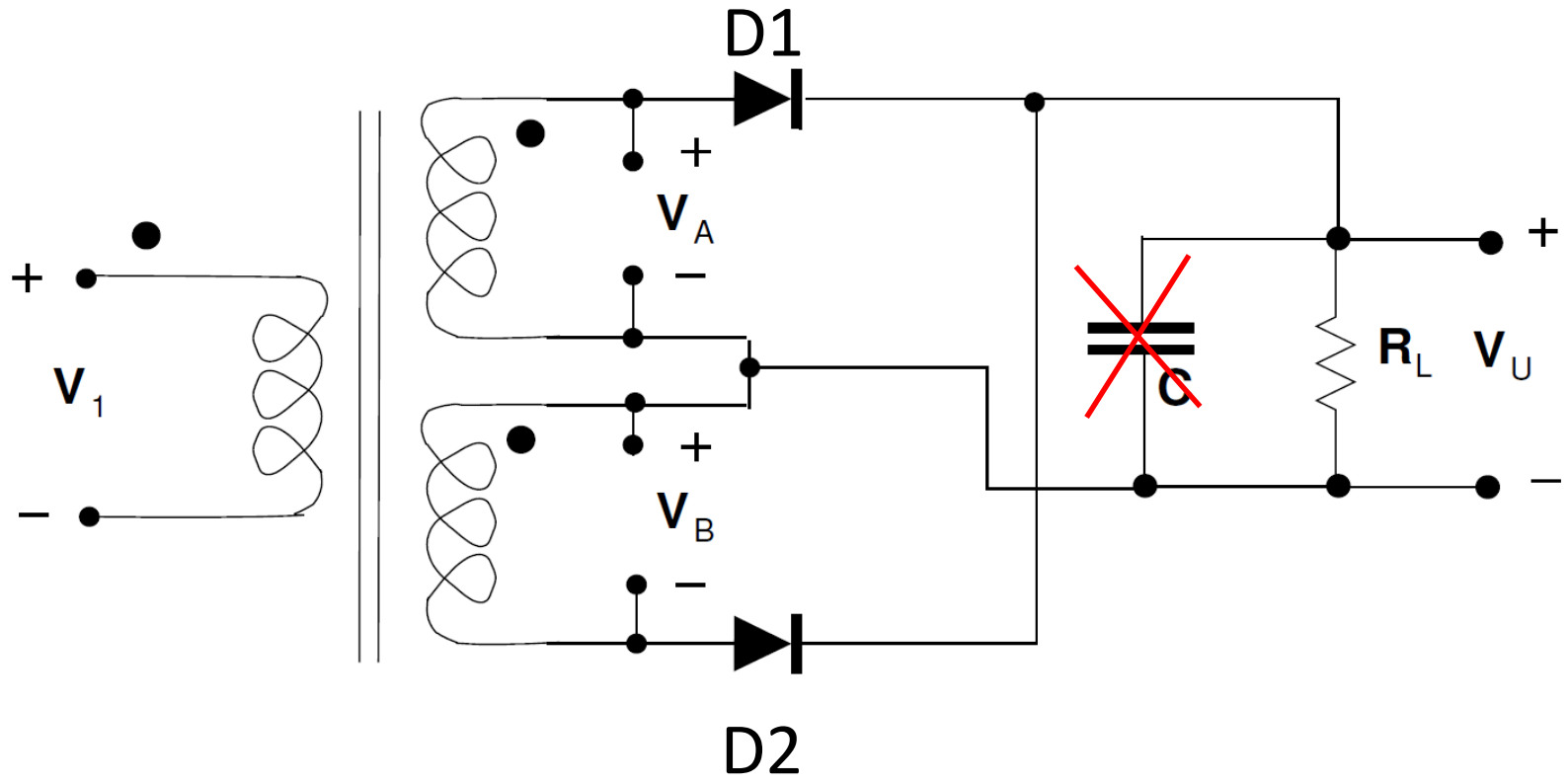


$V_1 > 0 \rightarrow V_A > 0, \quad V_B > 0$ Ipotesi: D1 ON e D2 OFF ➡ $V_u = V_A > 0$

$I_{D1} = \frac{V_A}{R_L} > 0$ ➡ D1 ON $\qquad V_{AK2} = V_{A2} - V_{K2} = -V_B - (V_A) = -V_B - V_A < 0$ ➡ D2 OFF

PIV=$2V_M$

Raddrizzatori a doppia semionda senza C

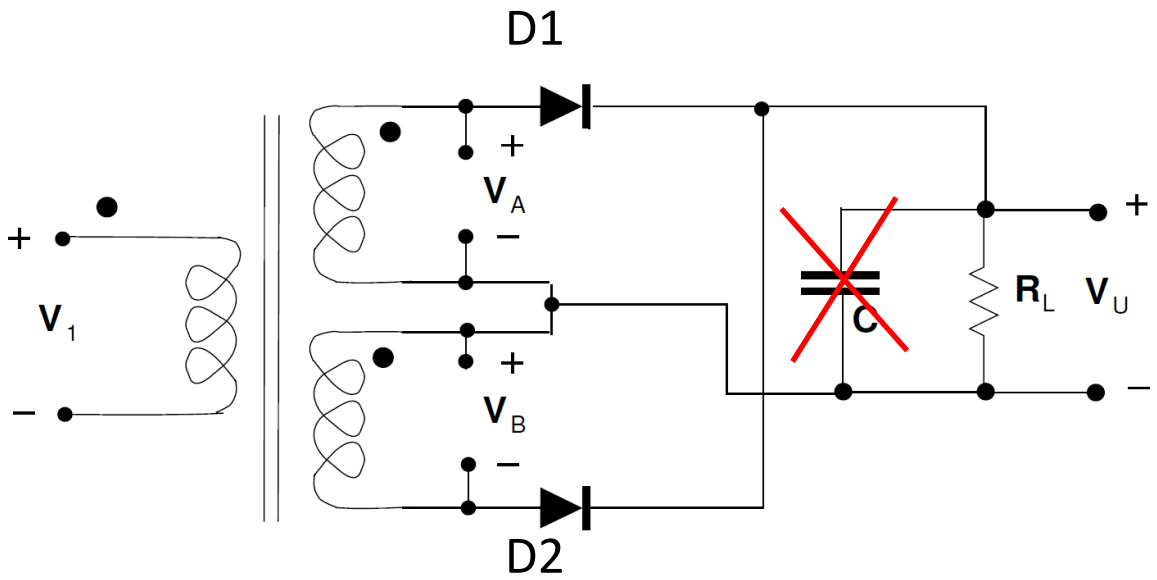


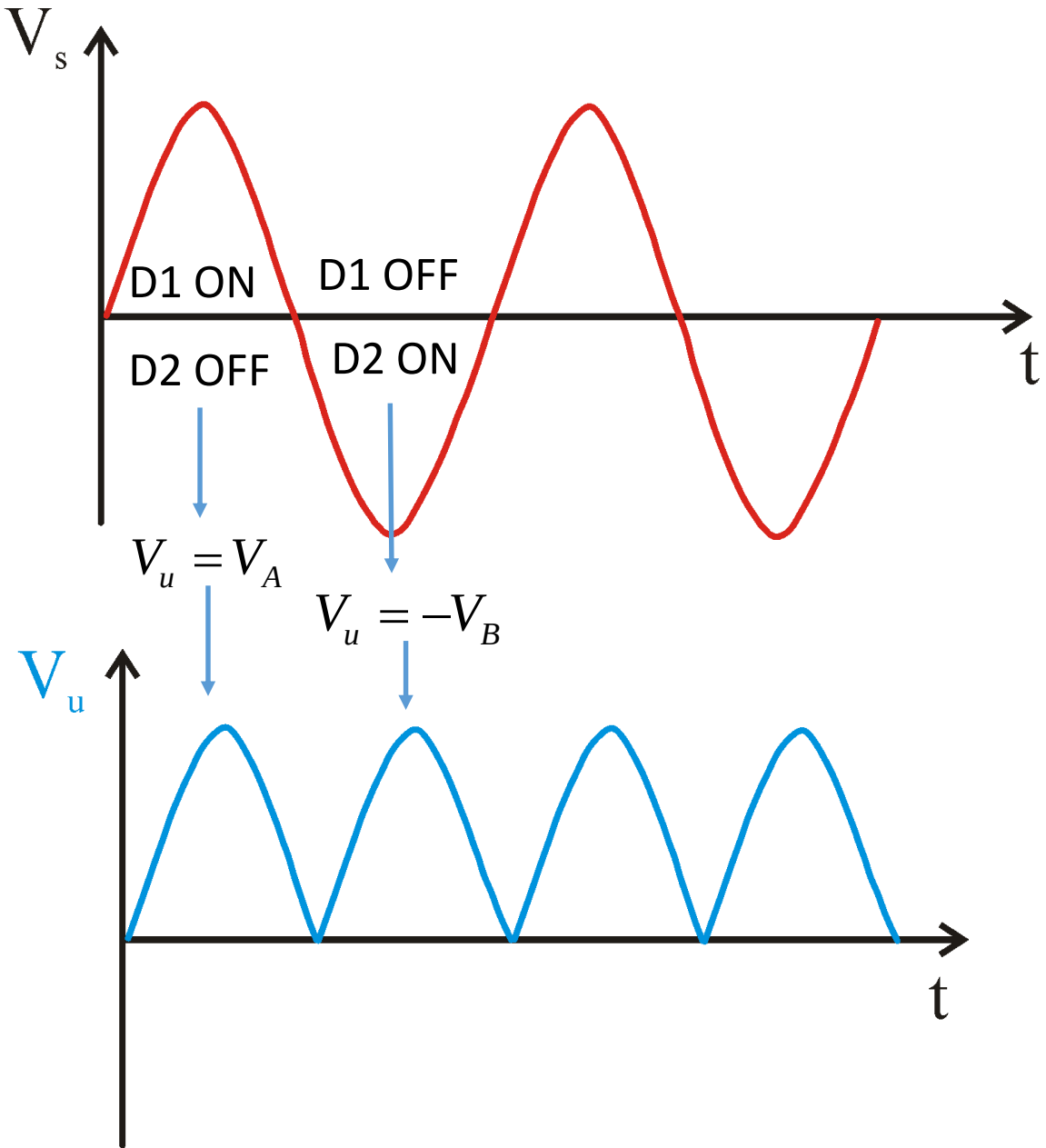
$V_1 < 0 \rightarrow V_A < 0, \quad V_B < 0$ Ipotesi: D1 OFF e D2 ON ➡ $V_u = -V_B > 0$

$I_{D2} = \frac{-V_B}{R_L} > 0$ ➡ D2 ON $\quad V_{AK1} = V_{A1} - V_{K1} = V_A - (-V_B) = V_A + V_B < 0$ ➡ D1 OFF

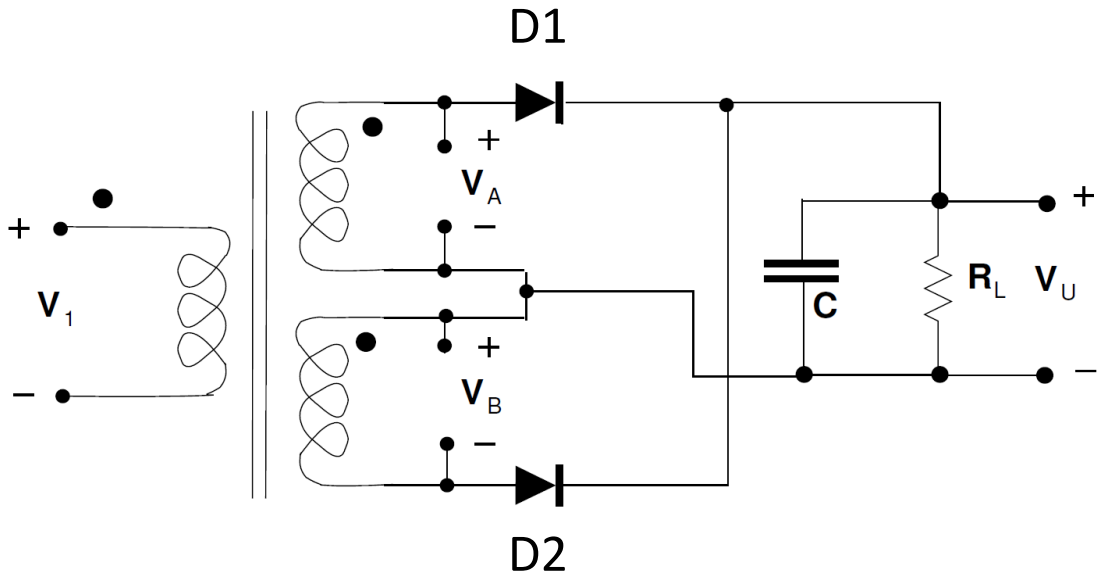
PIV=2V_M

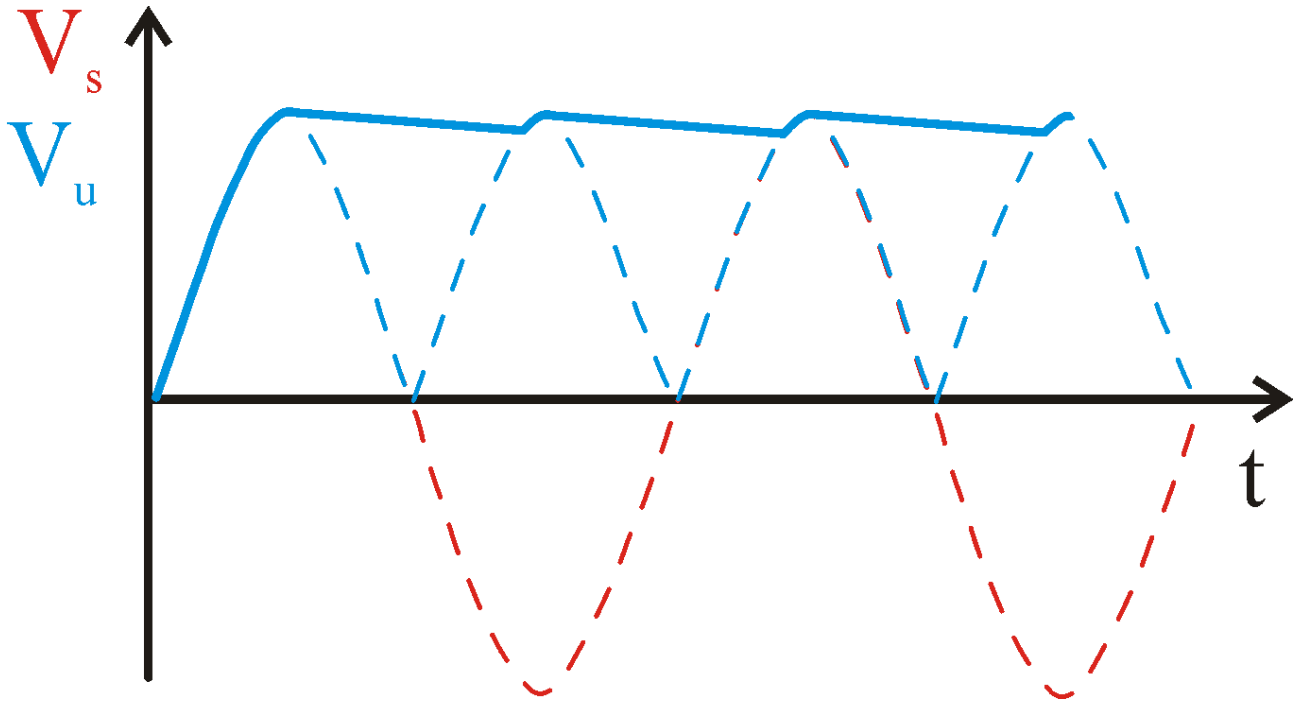
Raddrizzatori a doppia semionda senza C



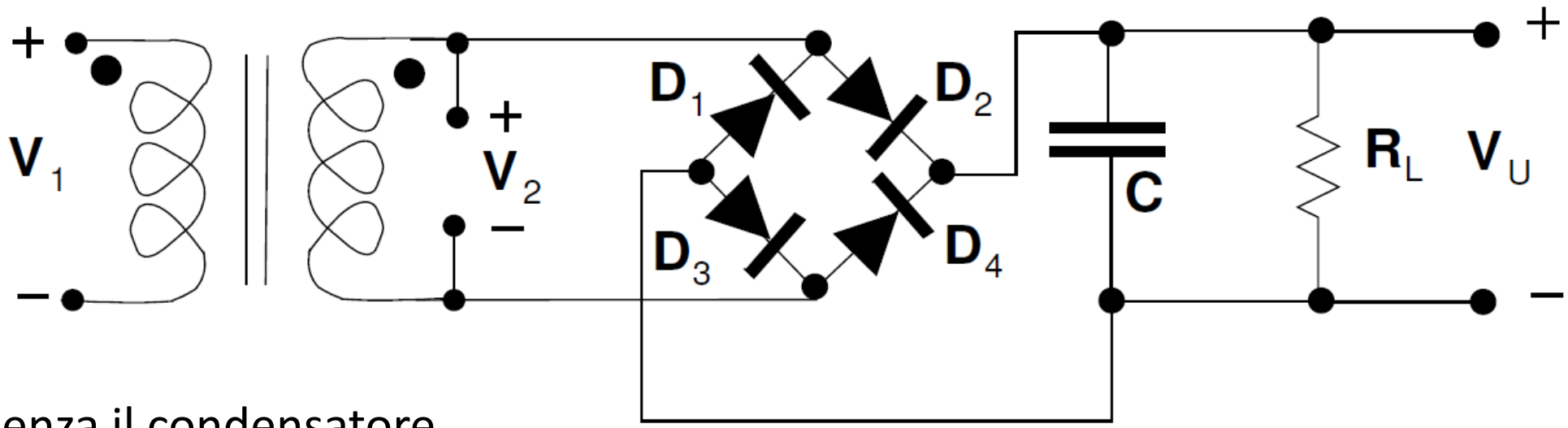


Raddrizzatori a doppia semionda con C





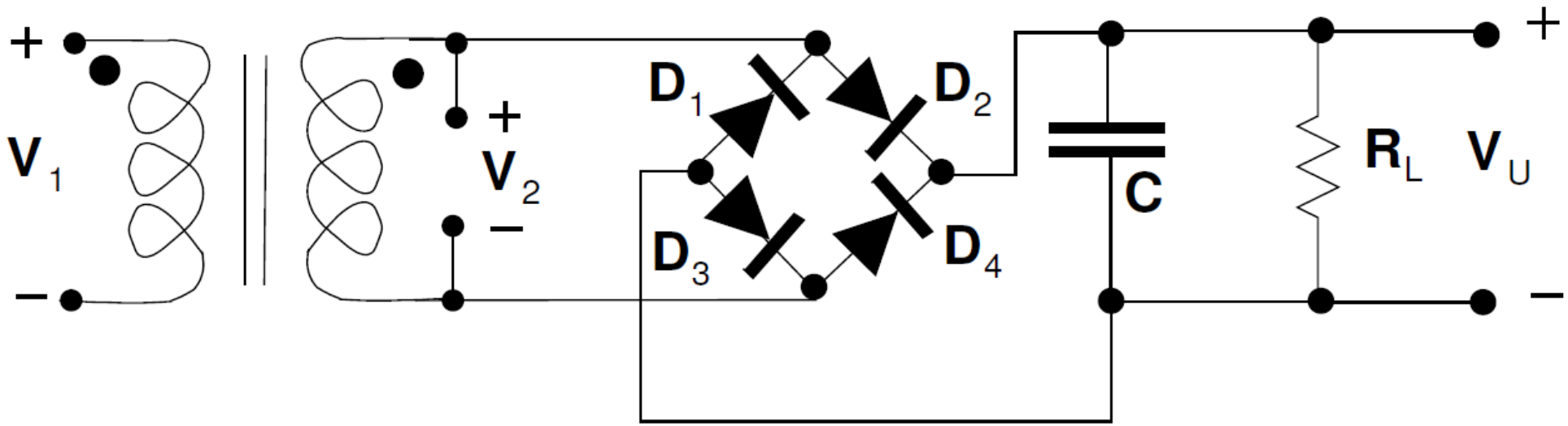
Raddrizzatore a ponte di Graetz



Senza il condensatore

$V_2 > 0$ D2 ON, D3 ON, D1 OFF, D4 OFF

Raddrizzatore a ponte di Graetz



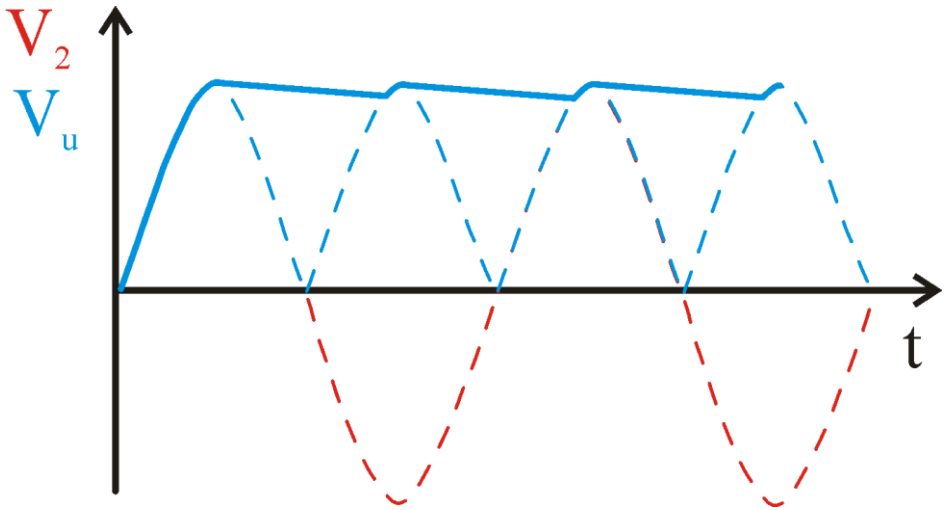
Senza il condensatore

$V_2 > 0$ D2 ON, D3 ON, D1 OFF, D4 OFF $V_u = V_2$

$V_2 < 0$ D1 ON, D4 ON, D2 OFF, D3 OFF $V_u = -V_2$

PIV=V_M

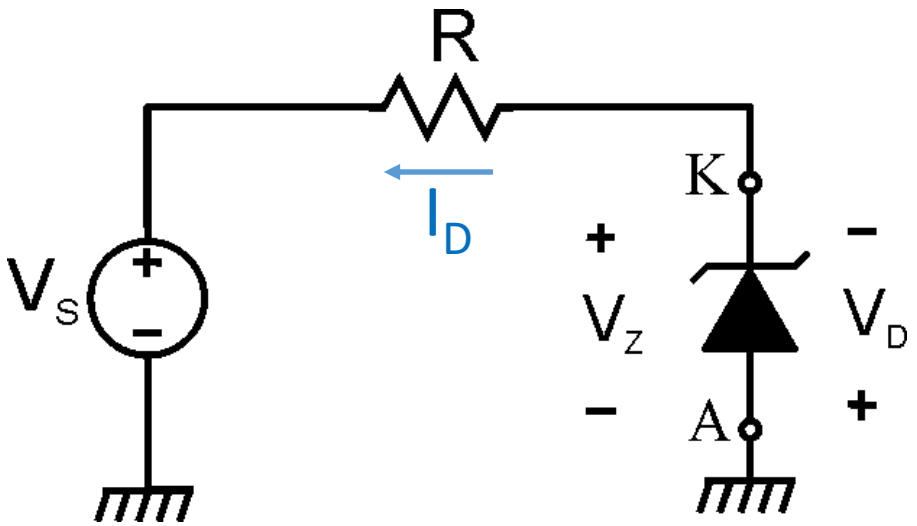
Con il condensatore



Confronto tra le configurazioni

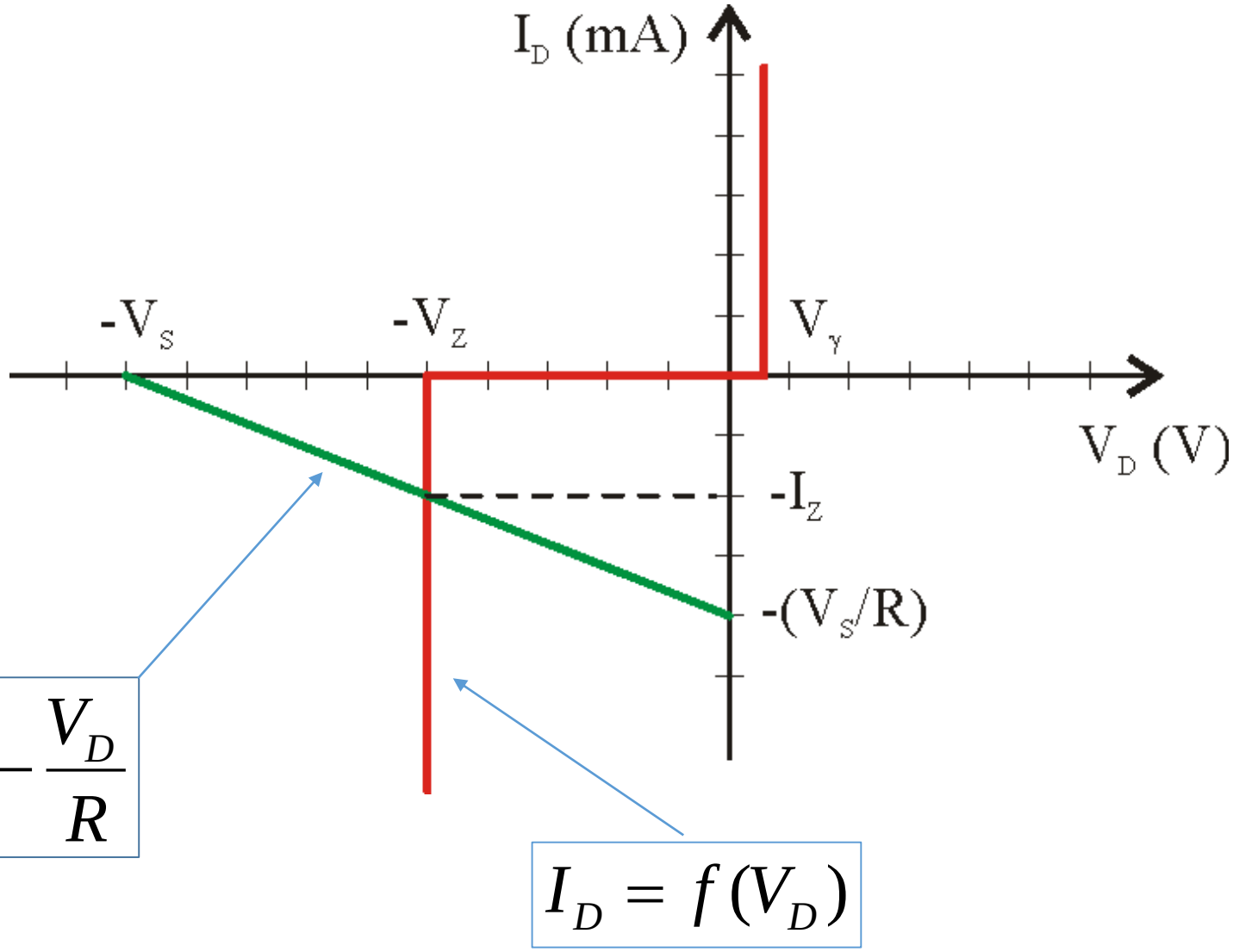
CONFIGURAZIONE	PIV	Perdita di segnale dovuta ai diodi
Rettificatore senza C	V_M	$V\gamma$
Rettificatore con C	$2V_M$	$V\gamma$
Raddrizzatore a doppia semionda con trasformatore a presa centrale	$2V_M$	$V\gamma$
Raddrizzatore a ponte di Graetz	V_M	$2V\gamma$

Circuiti con diodo Zener



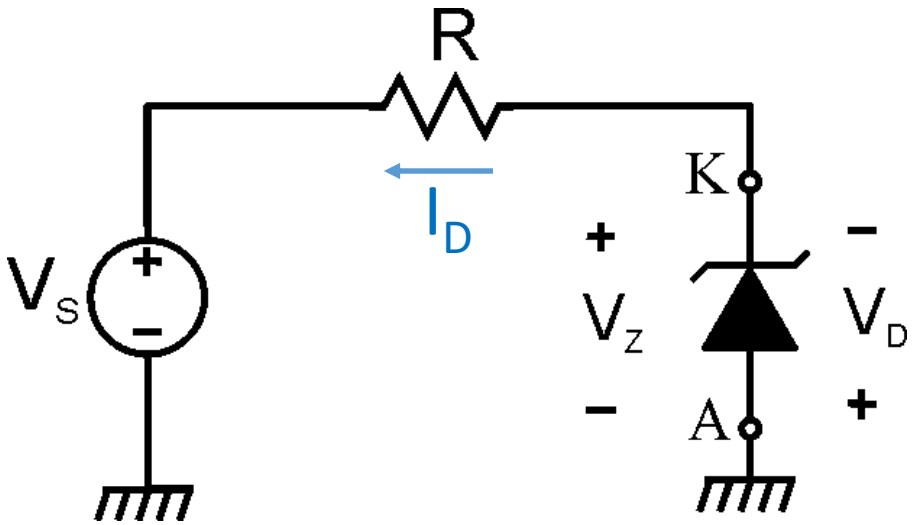
$$V_S = 10\,V \quad R = 5\,k\Omega \quad V_z = 5\,V$$

$$V_S = -RI_D - V_D \Rightarrow I_D = -\frac{V_S}{R} - \frac{V_D}{R}$$

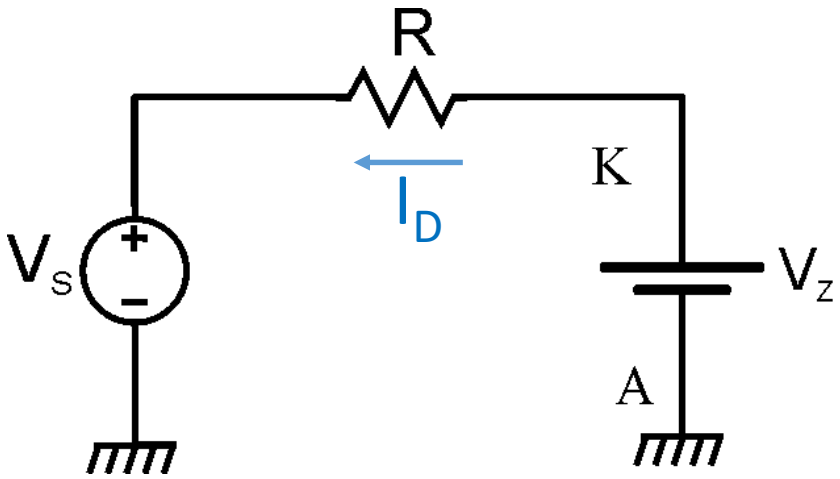


$$I_D = f(V_D)$$

Circuiti con diodo Zener



Ipotesi
Diodo in
breakdown



$$V_S = 10\,V \quad R = 5\,k\Omega \quad V_z = 5\,V$$

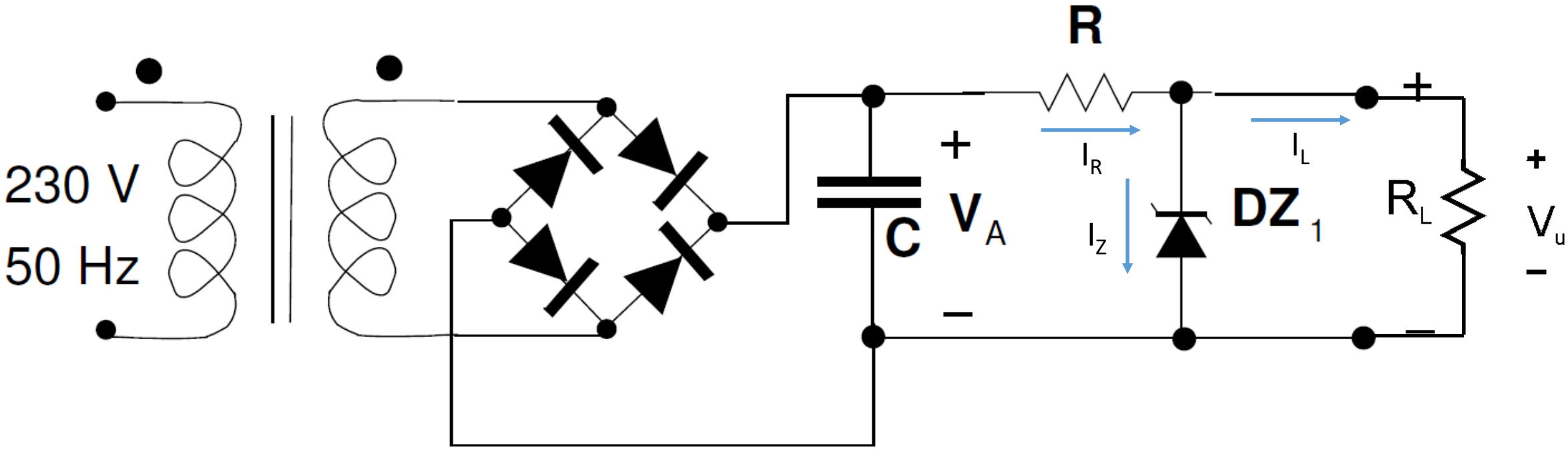
$$V_S = -RI_D - V_D \Rightarrow I_D = -\frac{V_S}{R} - \frac{V_D}{R} \Rightarrow \boxed{I_D = -\frac{V_S}{R} + \frac{V_Z}{R}}$$

$$\boxed{I_D = -\frac{V_S}{R} + \frac{V_Z}{R} = -2\times10^{-3} + 1\times10^{-3} = -1\,mA}$$

$$\boxed{I_D < 0}$$

Ipotesi
verificata

Regolatore di tensione con diodo Zener



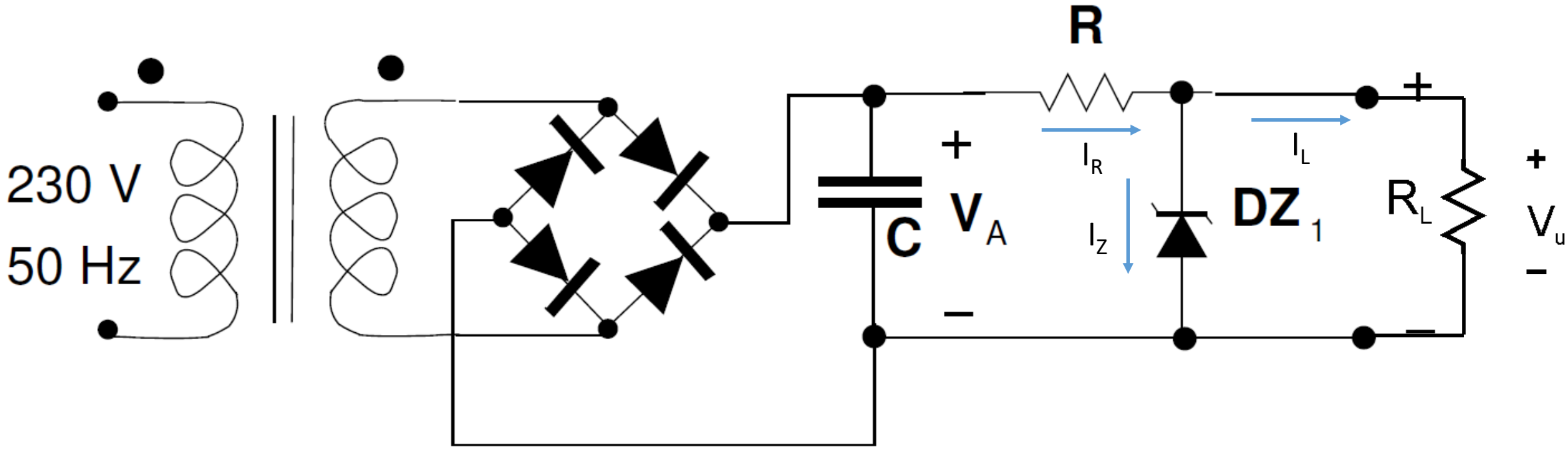
$$Se\ I_Z > 0$$

$$\boxed{V_u = V_Z}$$

$$\begin{cases} I_R = \dfrac{V_A - V_Z}{R} \\ I_L = \dfrac{V_Z}{R_L} \end{cases}$$

$$I_Z = I_R - I_L = \frac{V_A - V_Z}{R} - \frac{V_Z}{R_L}$$

Regolatore di tensione con diodo Zener



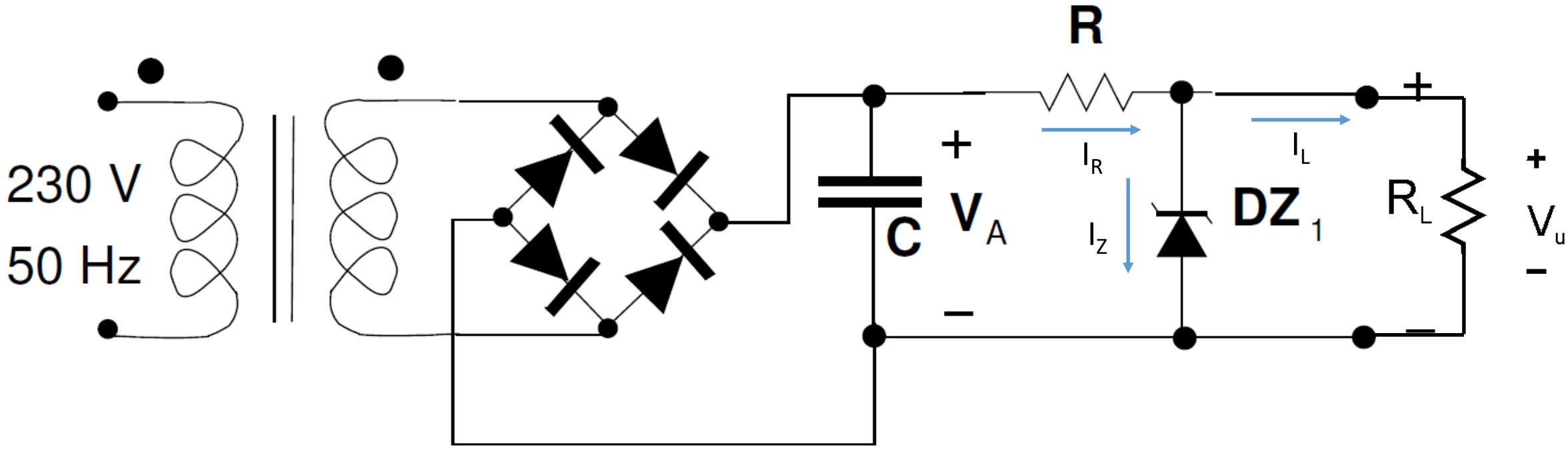
$$I_Z = I_R - I_L = \frac{V_A - V_Z}{R} - \frac{V_Z}{R_L} > 0$$

$$I_Z = 0 \rightarrow I_{LMax} = I_R = \frac{V_A - V_Z}{R}$$

$$I_L = 0 \rightarrow I_{ZMax} = I_R = \frac{V_A - V_Z}{R}$$

$$P_{Z\max} = V_Z I_{ZMax} = V_Z \frac{V_A - V_Z}{R}$$

Regolatore di tensione con diodo Zener



Tensione di ingresso variabile

$$V_{AMin} \le V_A \le V_{AMax}$$

$$I_{LMax} = \frac{V_{AMin} - V_Z}{R}$$

$$P_{Z\max} = V_Z \frac{V_{AMax} - V_Z}{R}$$