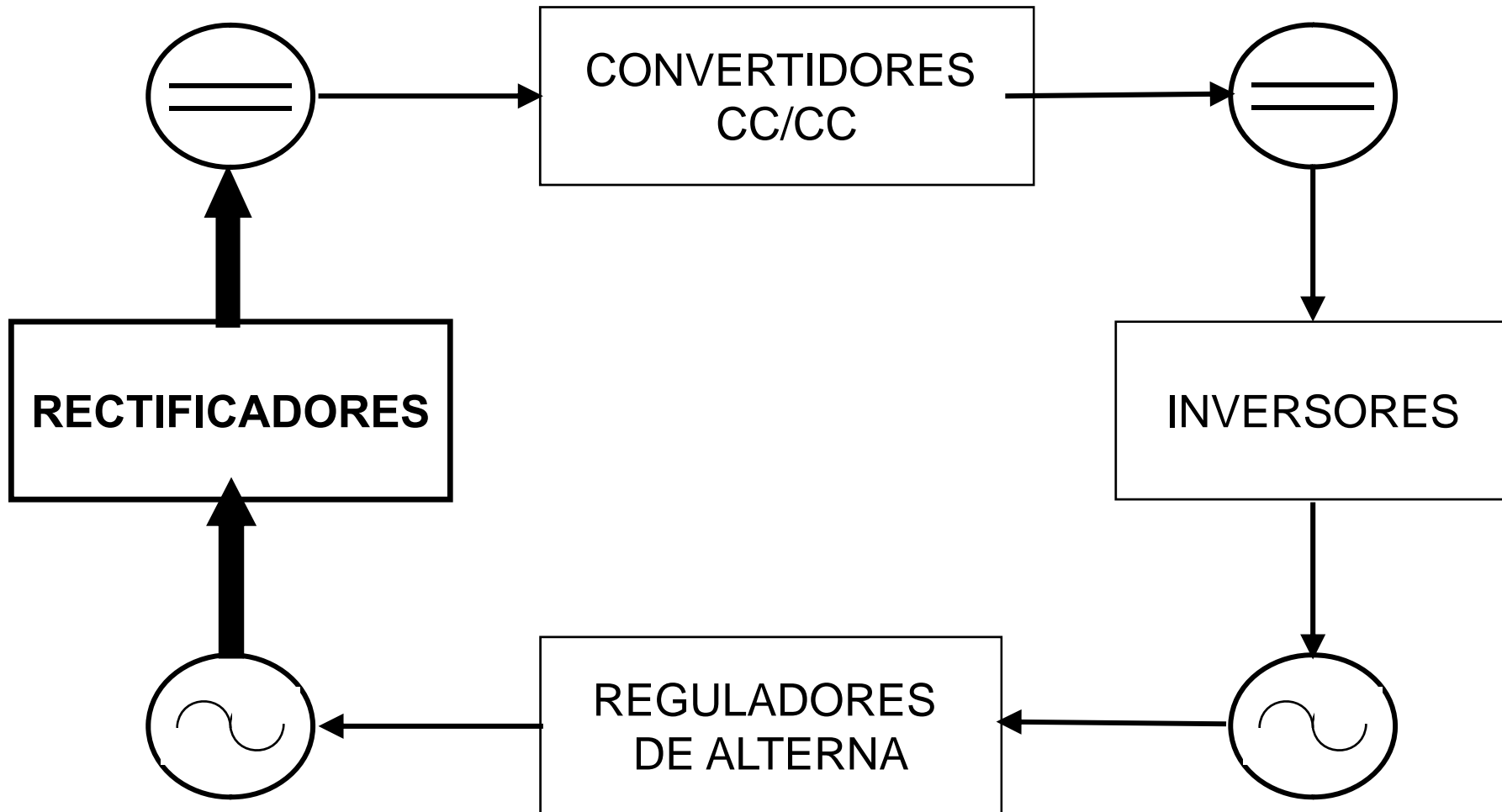




Conversión CA/CC. Rectificadores

Tema 3

SITUACIÓN DENTRO DE LA ELECTRÓNICA DE POTENCIA





CLASIFICACIÓN RECTIFICADORES

1. SEGÚN EL NÚMERO DE FASES.

- Monofásicos.
- Trifásicos.
- N-fásicos.

2. EN FUNCIÓN DEL DISPOSITIVO

- No controlados.
- Semicontrolados.
- Totalmente controlados.

3. DEPENDIENDO DEL APROVECHAMIENTO DE LA SENOIDE.

- Media onda.
- Onda completa.

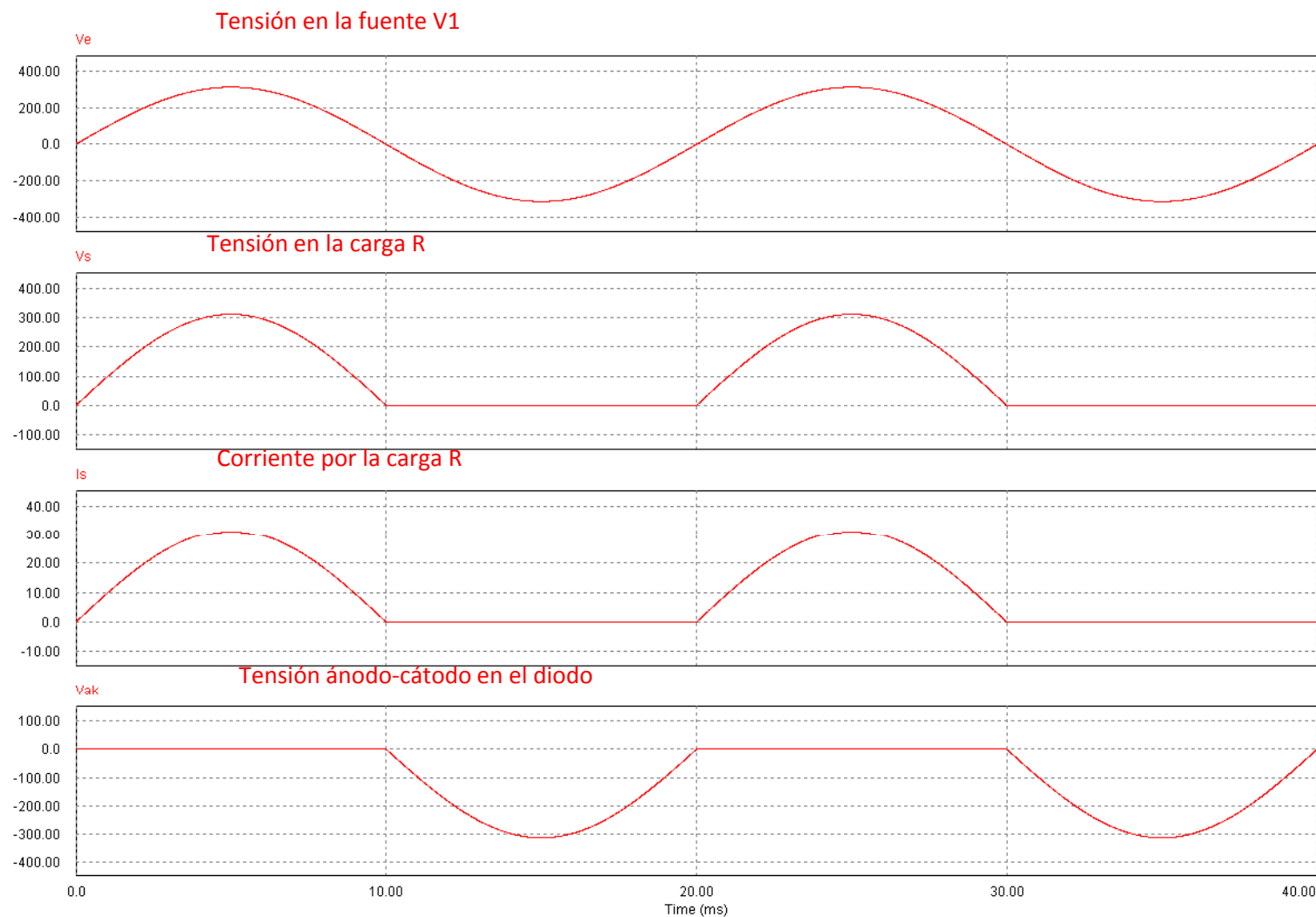
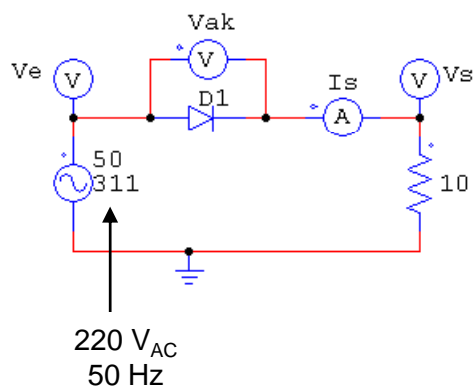
4. EN FUNCIÓN DE LA CONTROLABILIDAD DEL SISTEMA

- No controlados.
- Semicontrolados.
- Totalmente controlados.



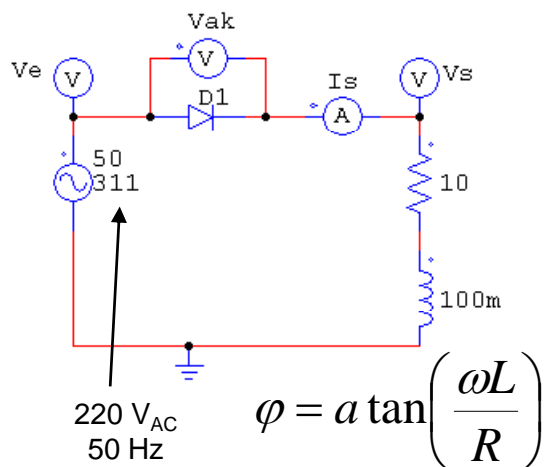
RECTIFICADORES NO CONTROLADOS (DIODOS)

Rectificador de media onda carga R

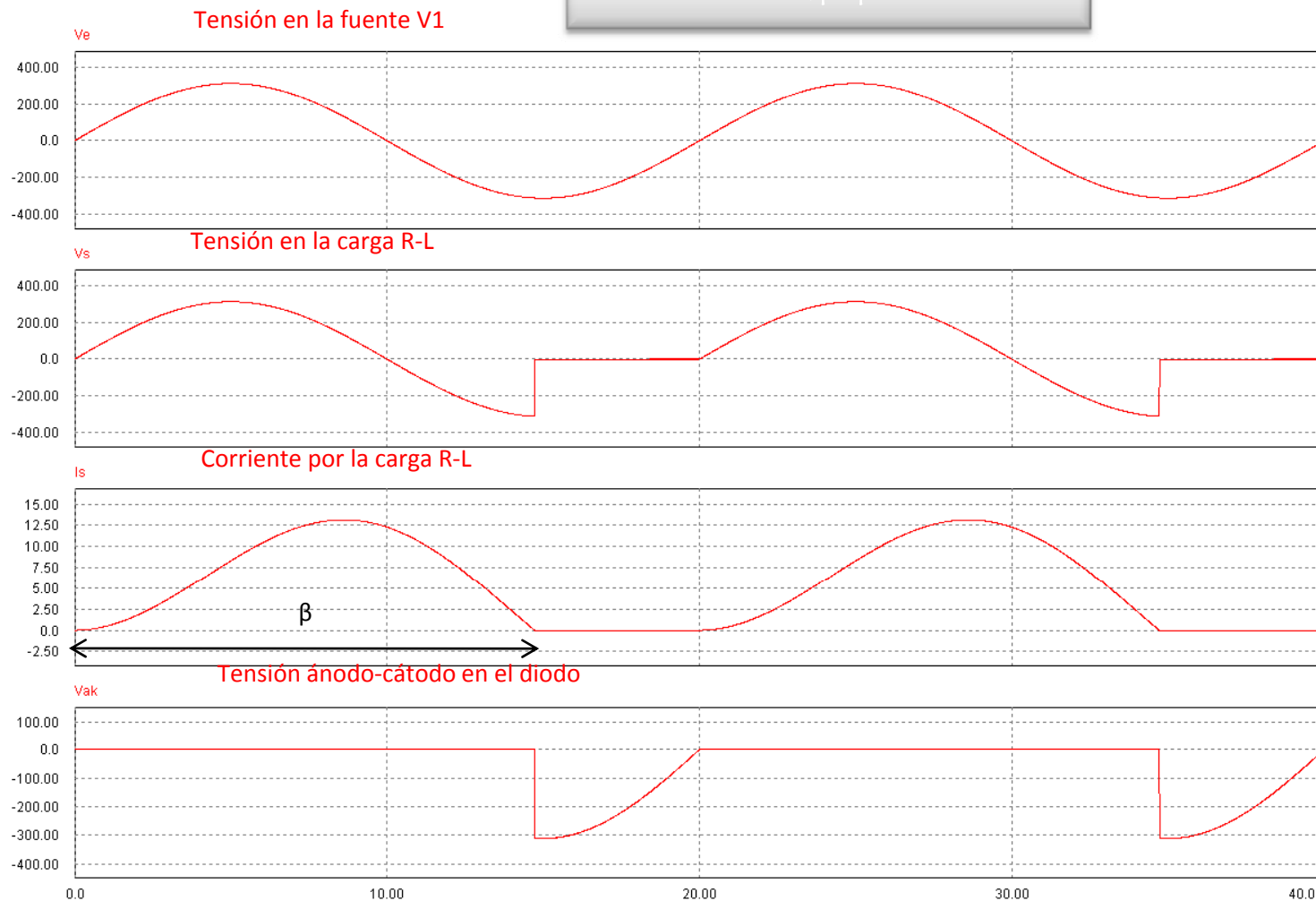


Rectificador de media onda carga RL

Problema propuesto 1

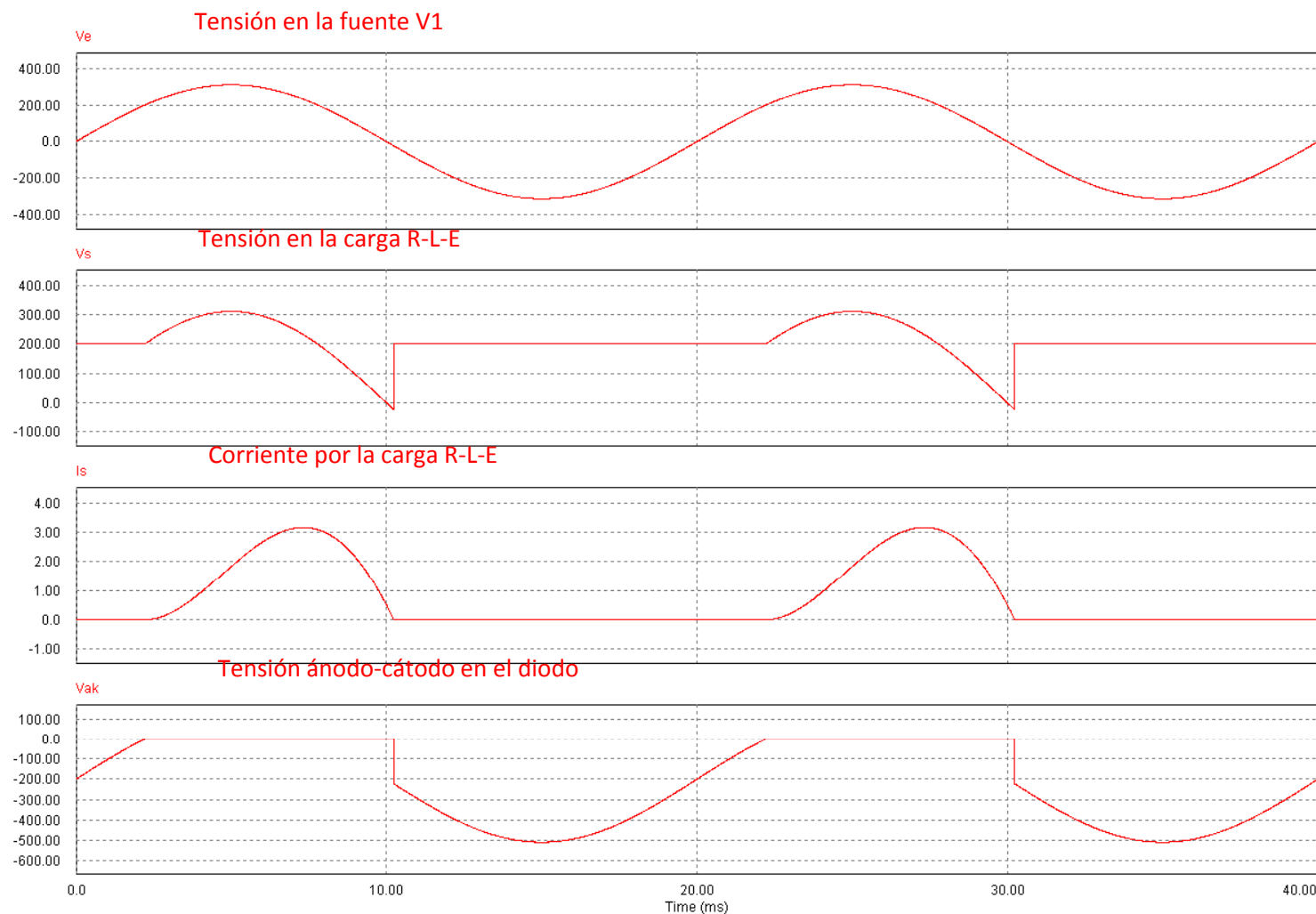
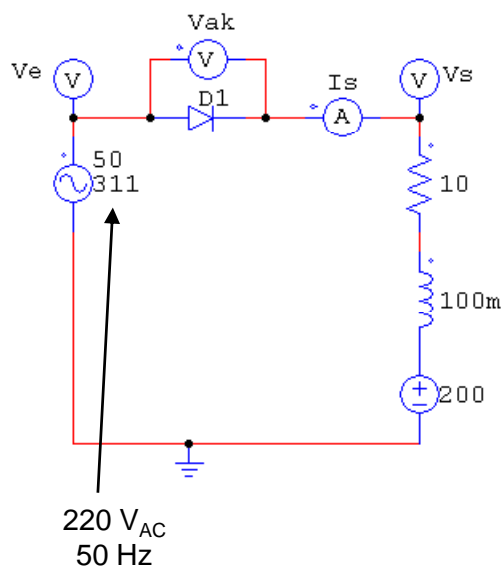


Ángulo de extinción de la corriente β : instante en el que se produce el apagado del diodo



Expresión de la corriente por la carga:
$$i(t) = \frac{U_g}{Z} \cdot \sin(\omega t - \varphi) + \frac{U_g}{Z} \cdot \sin(\varphi) \cdot e^{-t \cdot R/L}$$

Rectificador de media onda carga RLE

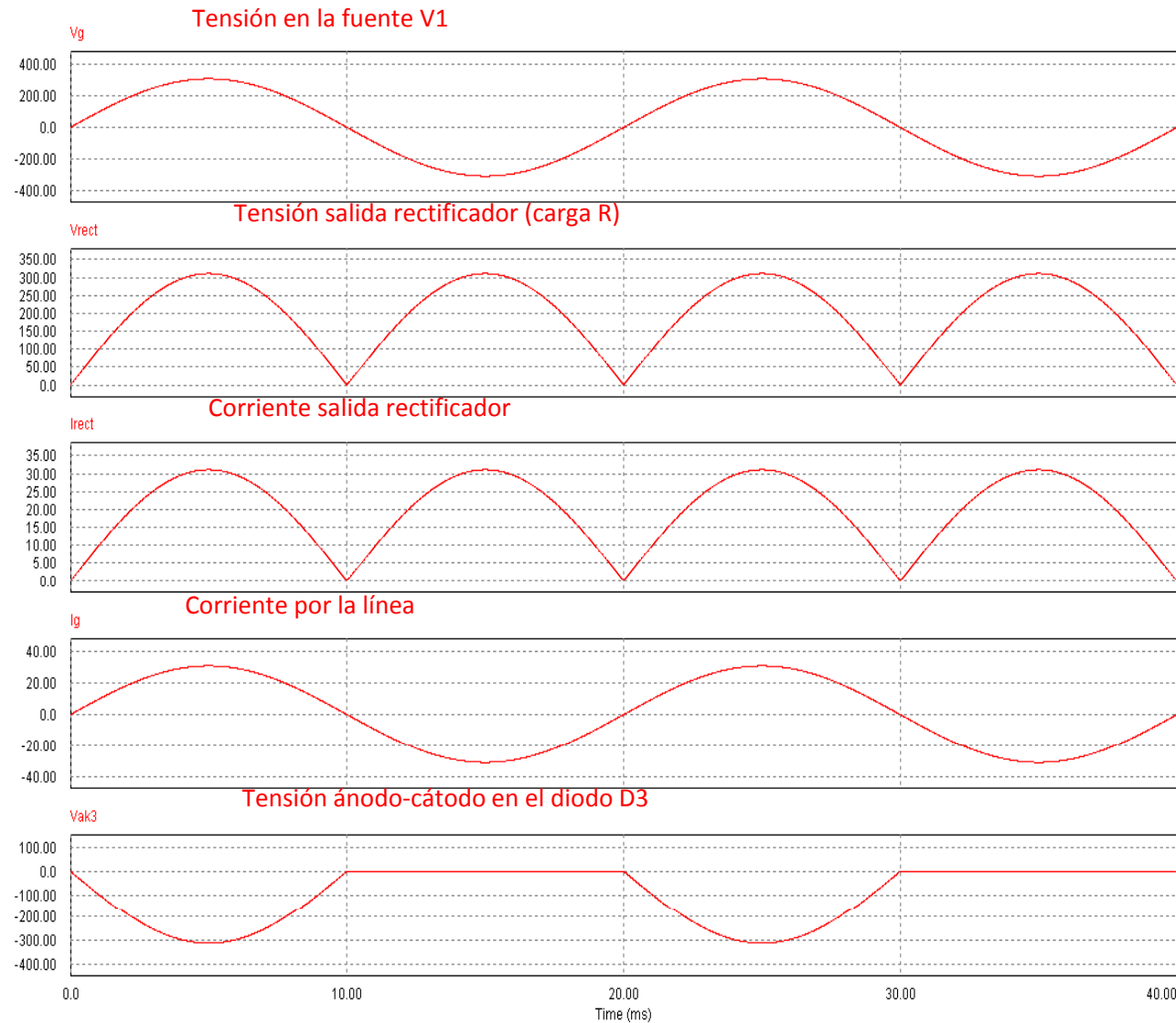
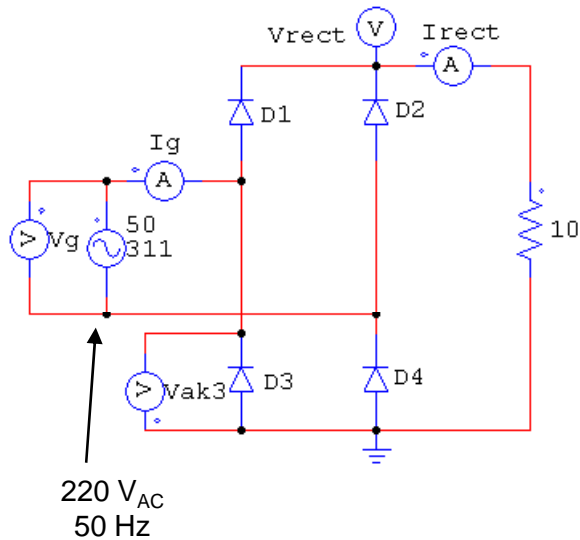


Expresión de la corriente por la carga:
Tema 3. Rectificadores

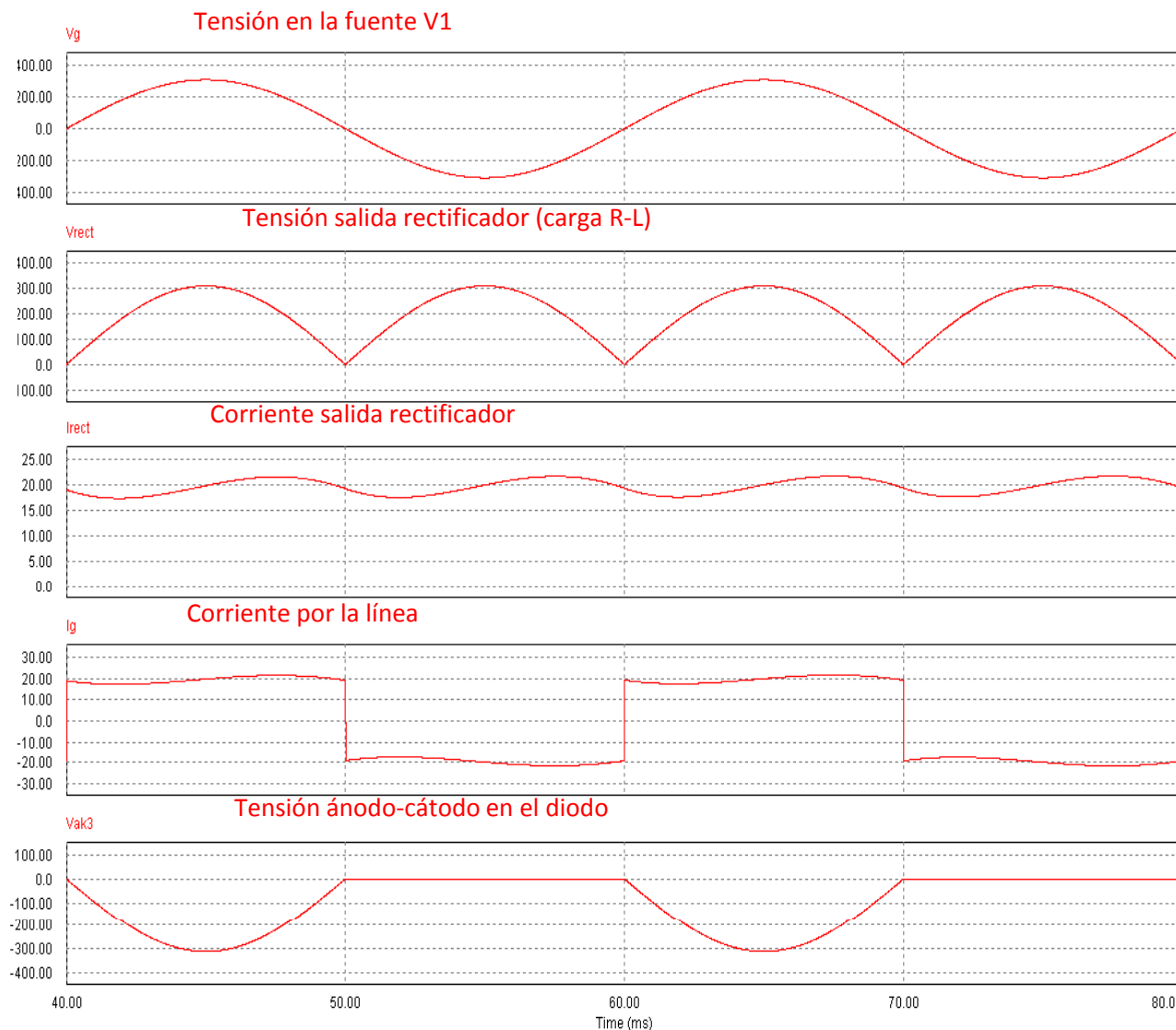
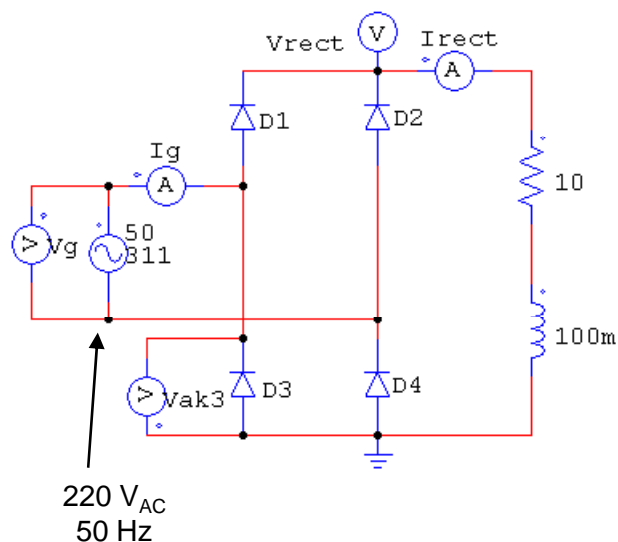
$$i(t) = \frac{U_g}{Z} \cdot \sin(\omega t - \varphi) - \frac{E}{R} + \left(\frac{U_g}{Z} \cdot \sin(\varphi) + \frac{E}{R} \right) \cdot e^{-t \cdot R/L}$$

<http://gsep.uc3m.es>

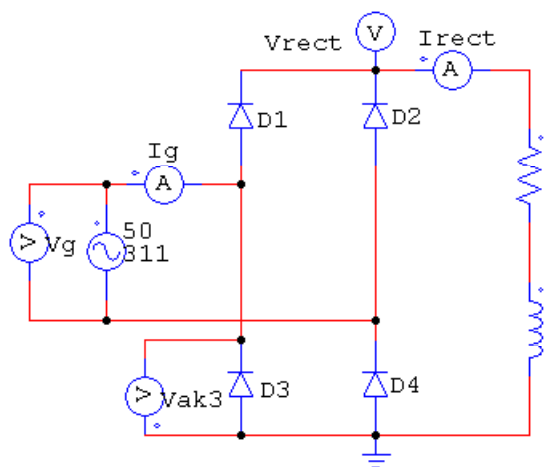
Rectificador de onda completa con carga R



Rectificador onda completa carga RL (100 mH)



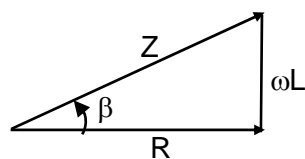
RECTIFICADORES NO CONTROLADOS



$$V_e = V_L + V_R \Rightarrow V_{\max} \cdot \text{sen}(\omega t) = L \cdot \frac{di(t)}{dt} + i(t) \cdot R$$

✓ Aplicamos Laplace

$$V_{\max} \cdot \frac{\omega}{s^2 + \omega^2} = L \cdot [s \cdot I(s) - I_0] + I(s) \cdot R \quad I_0 \neq 0 \Rightarrow I(s) = \frac{V_{\max} \cdot \omega}{s^2 + \omega^2} \cdot \frac{1}{L \cdot s + R} + \frac{L \cdot I_0}{L \cdot s + R}$$



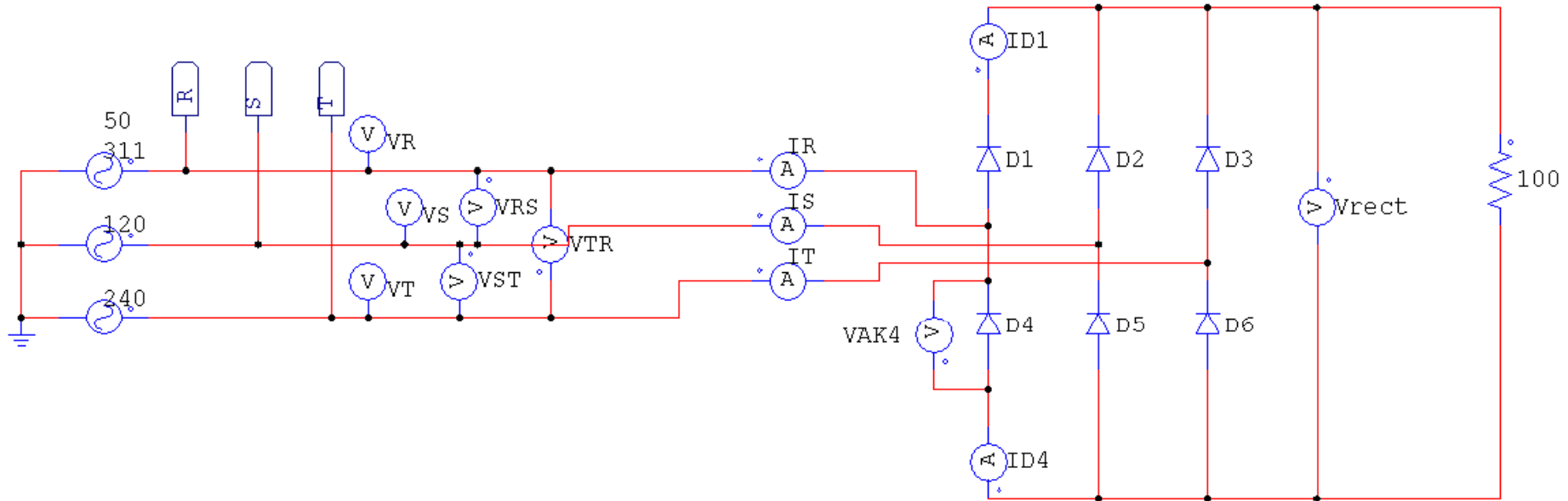
$$Z = \sqrt{R^2 + (\omega L)^2}$$

$$\beta = \text{arctg}\left(\frac{\omega L}{R}\right)$$

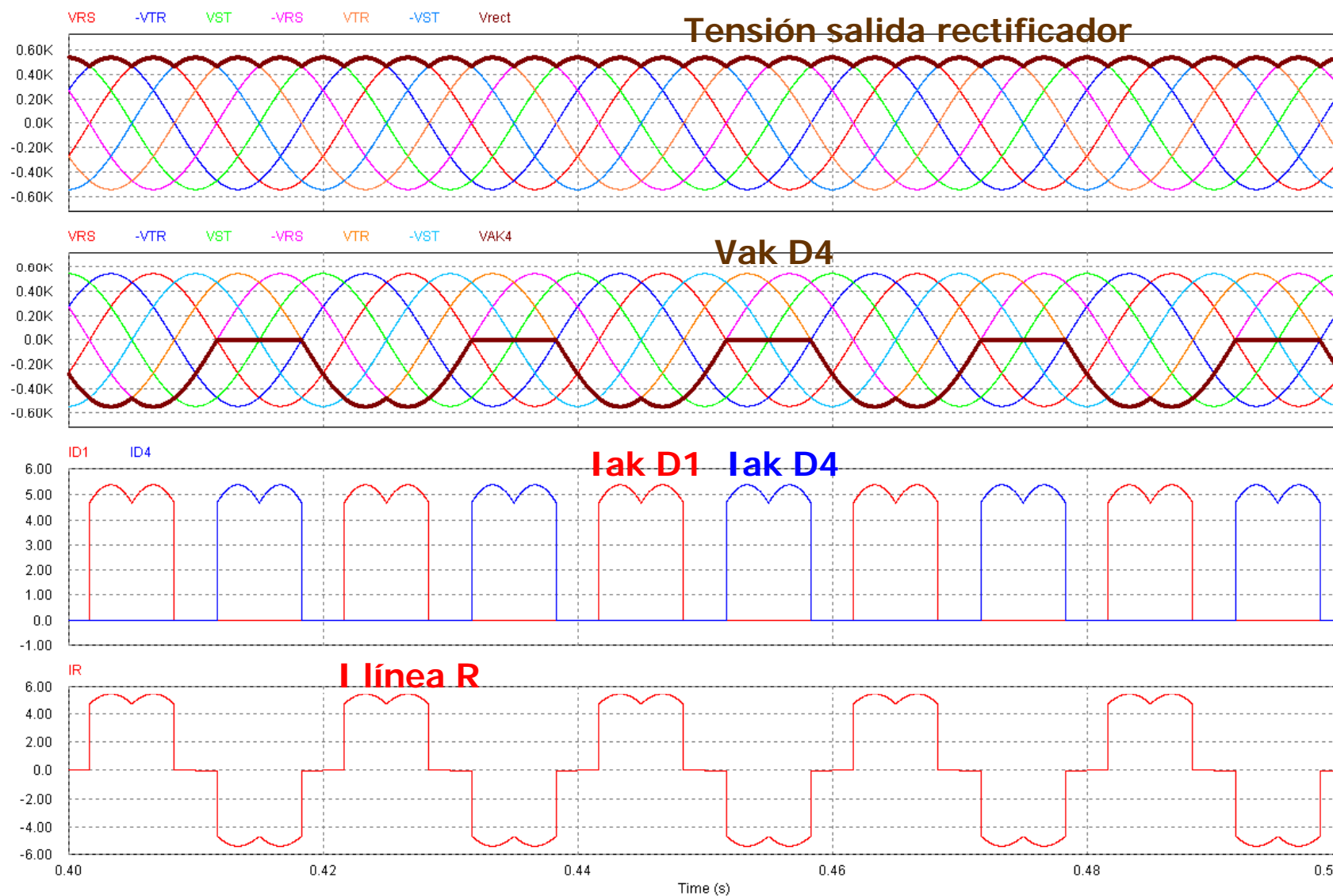
$$i(t) = \frac{V_{\max}}{Z} \cdot \text{sen}(\omega t - \beta) + \frac{\omega \cdot L \cdot V_{\max}}{Z^2} \cdot e^{-\frac{R}{L}t} + I_0 \cdot e^{-\frac{R}{L}t}$$

\mathcal{L}^{-1}

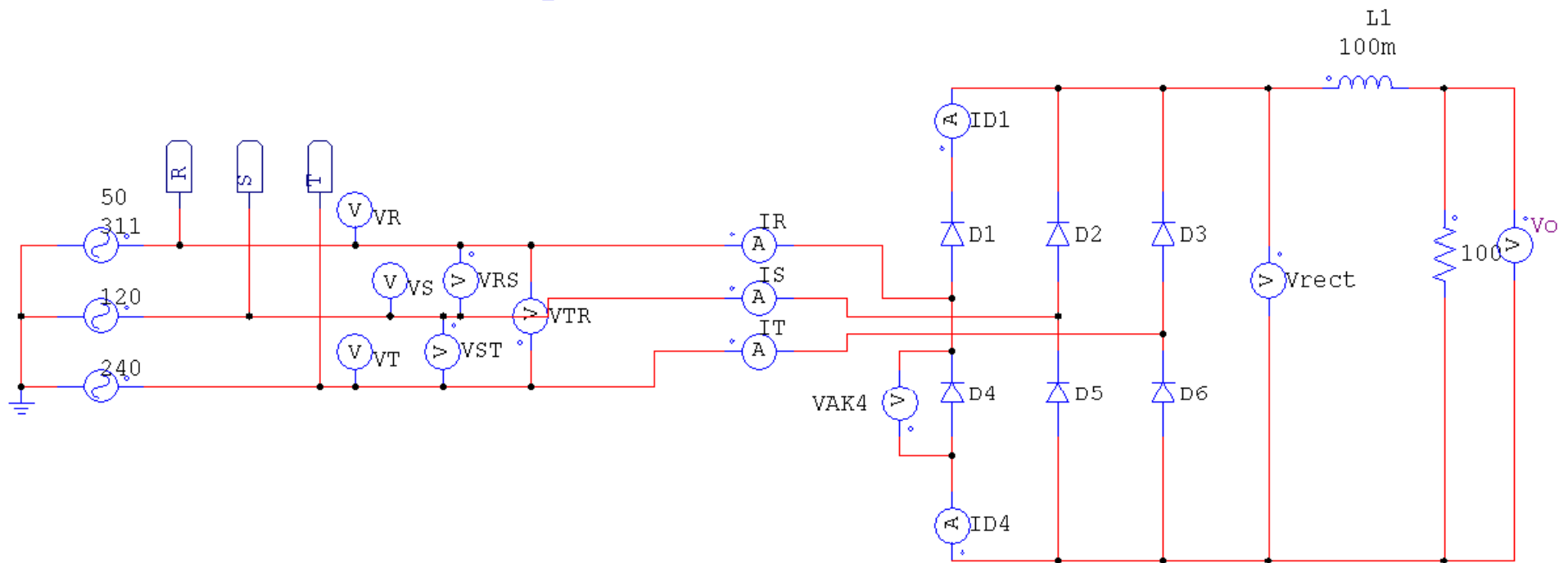
Carga R



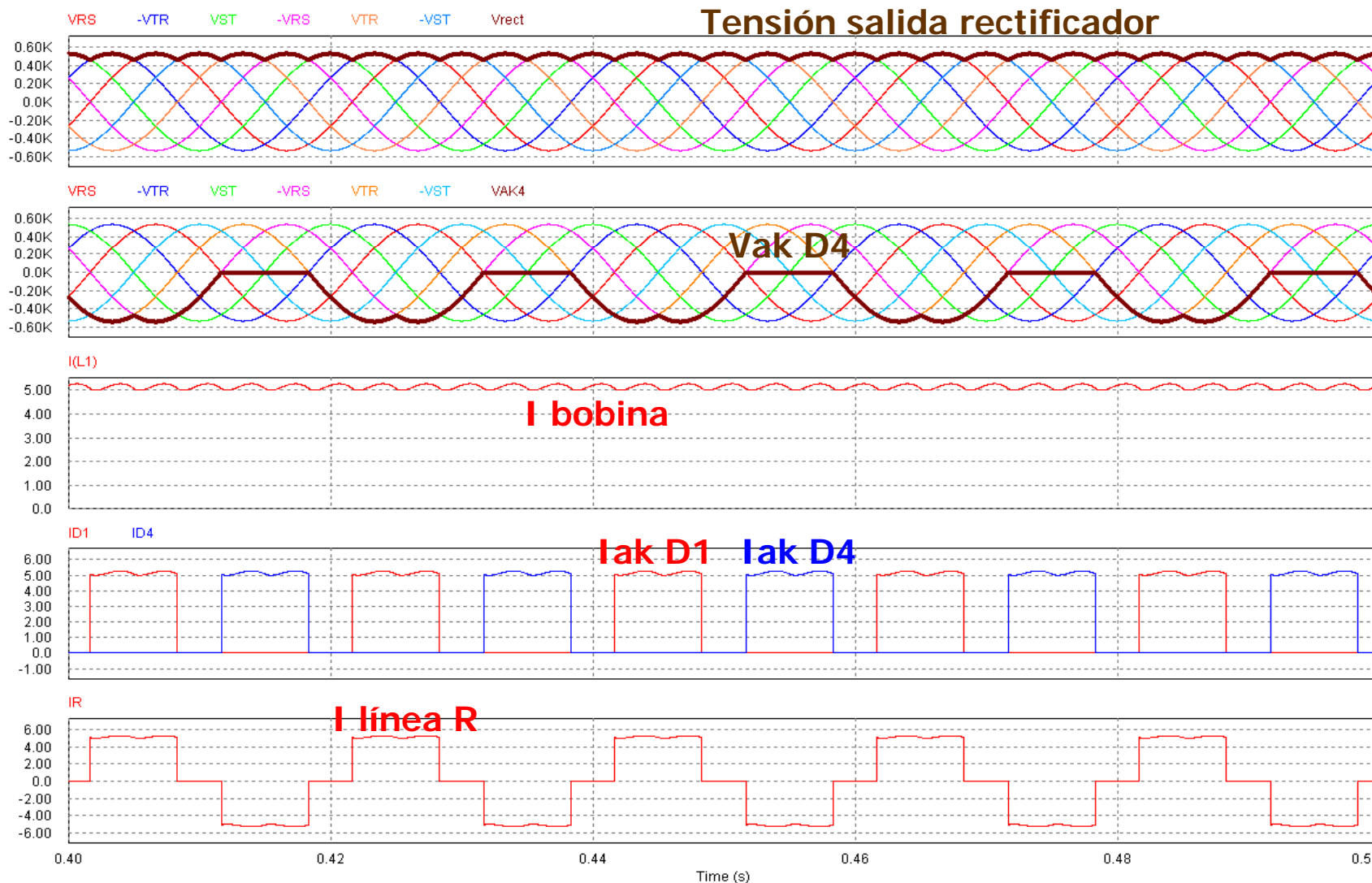
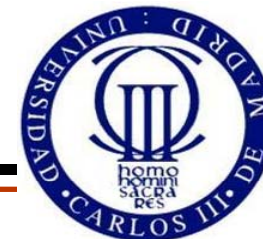
Carga R



Carga RL



Carga RL

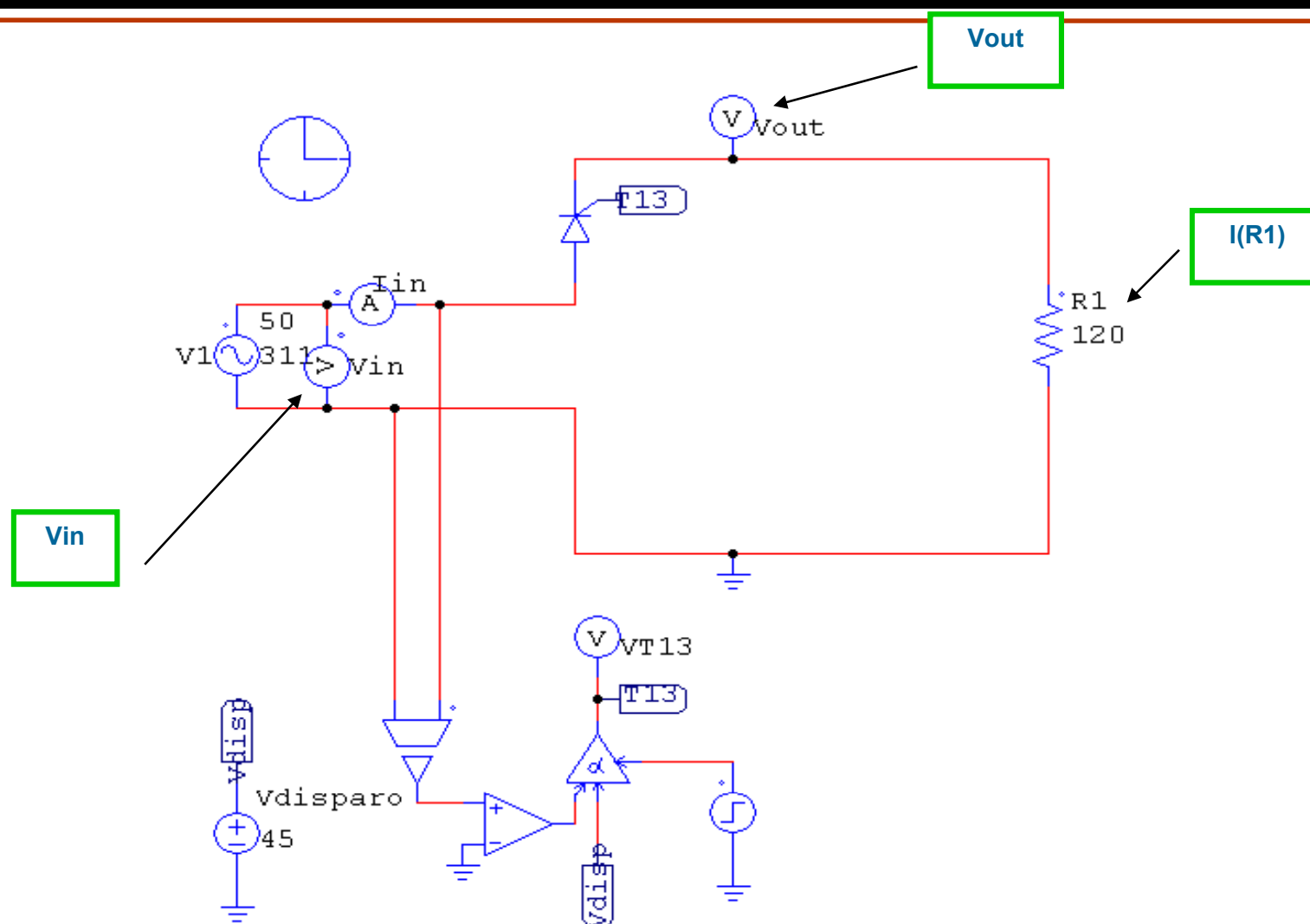




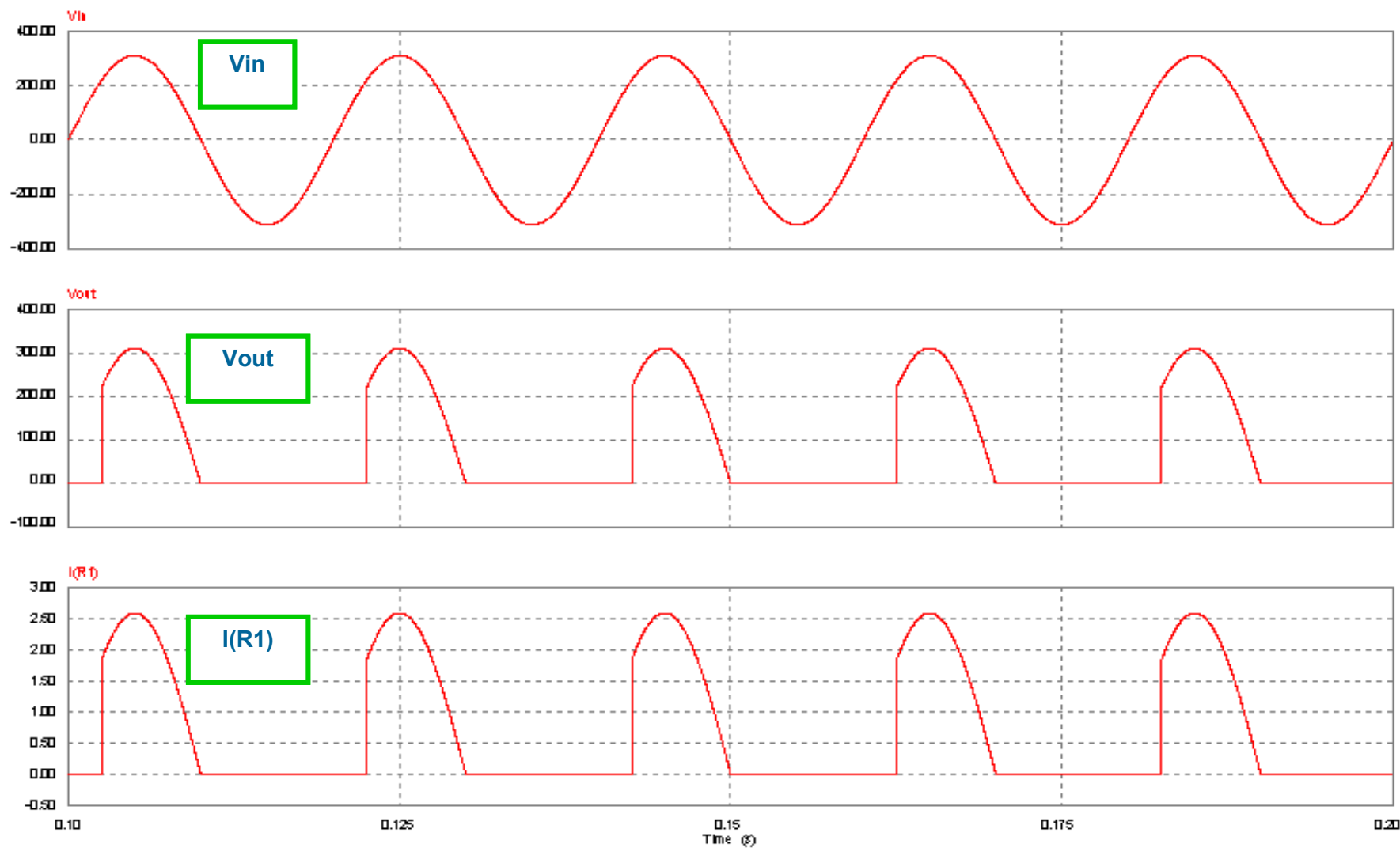
RECTIFICADORES CONTROLADOS Y SEMICONTROLADOS

(TIRISTOR)

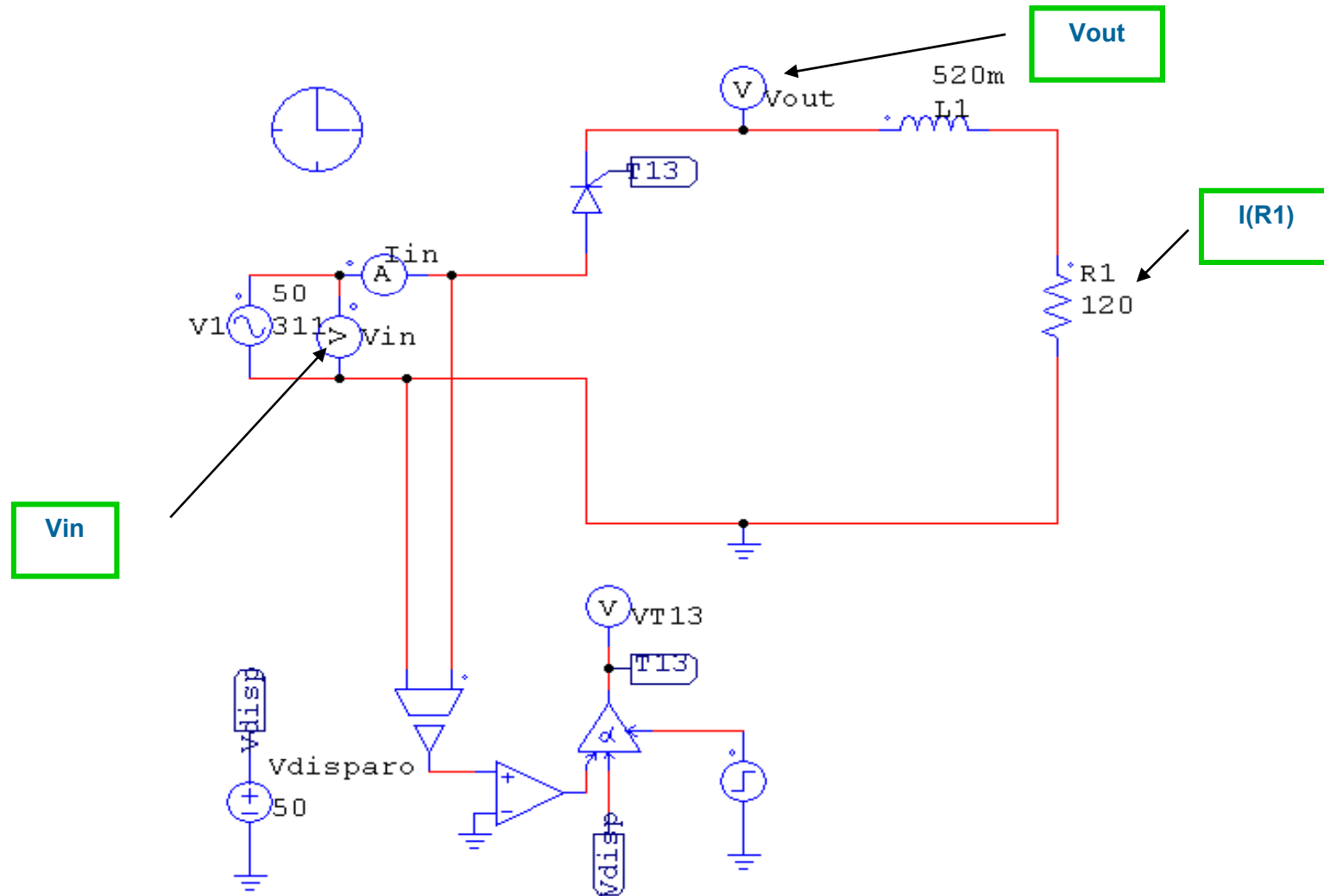
Media onda, carga R (I)



Media onda, carga R (II)

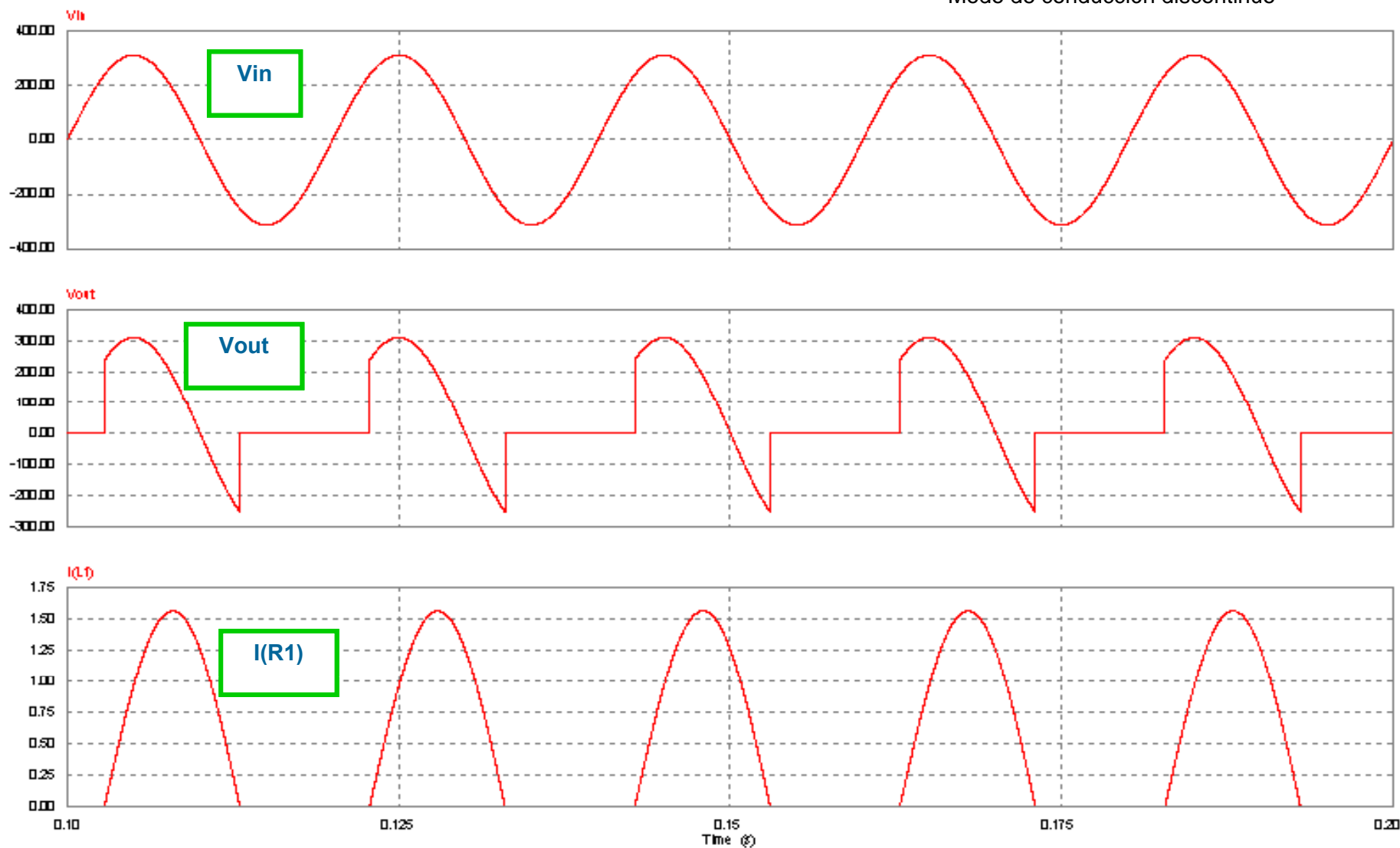


Media onda, carga RL (I)

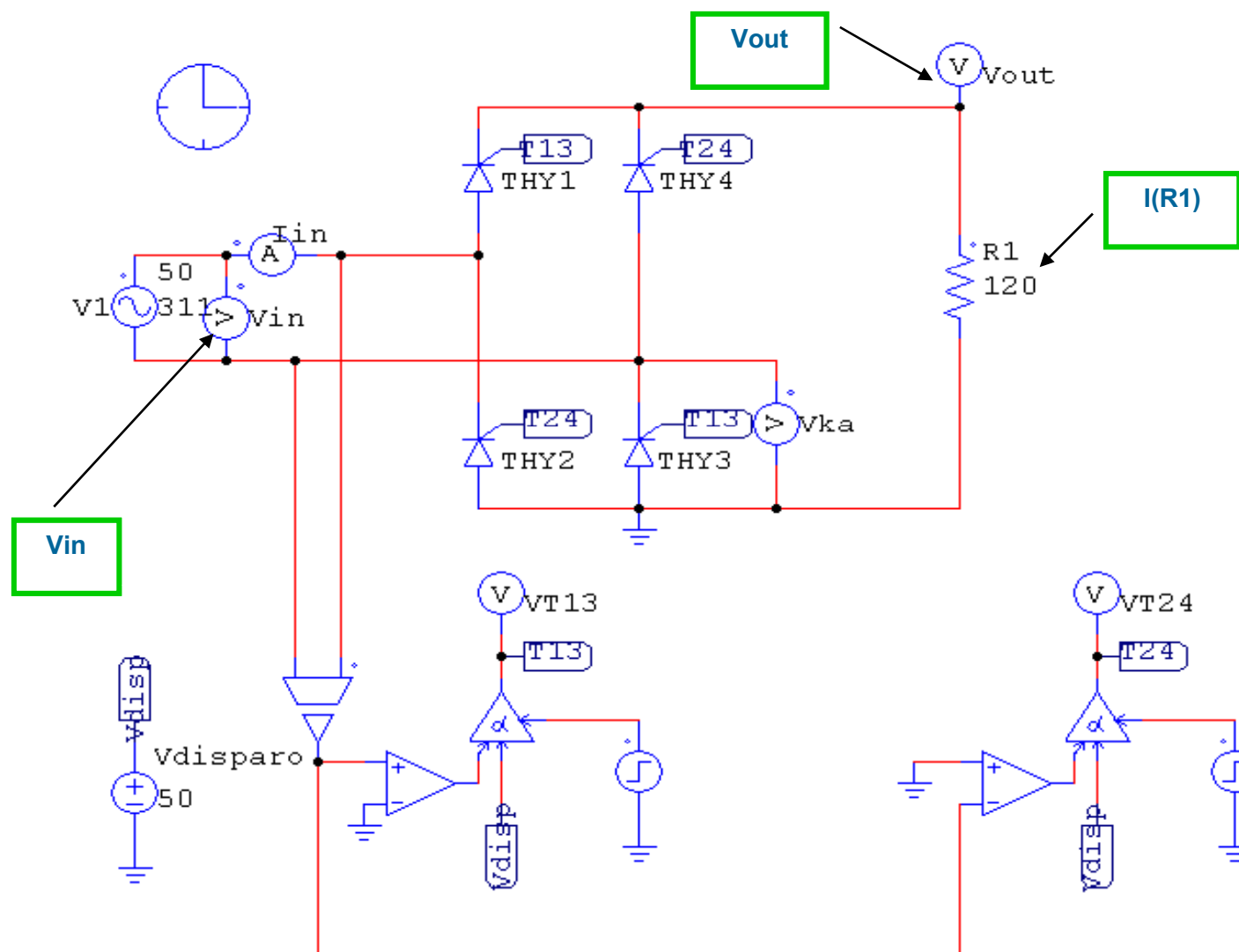


Media onda, carga RL (II)

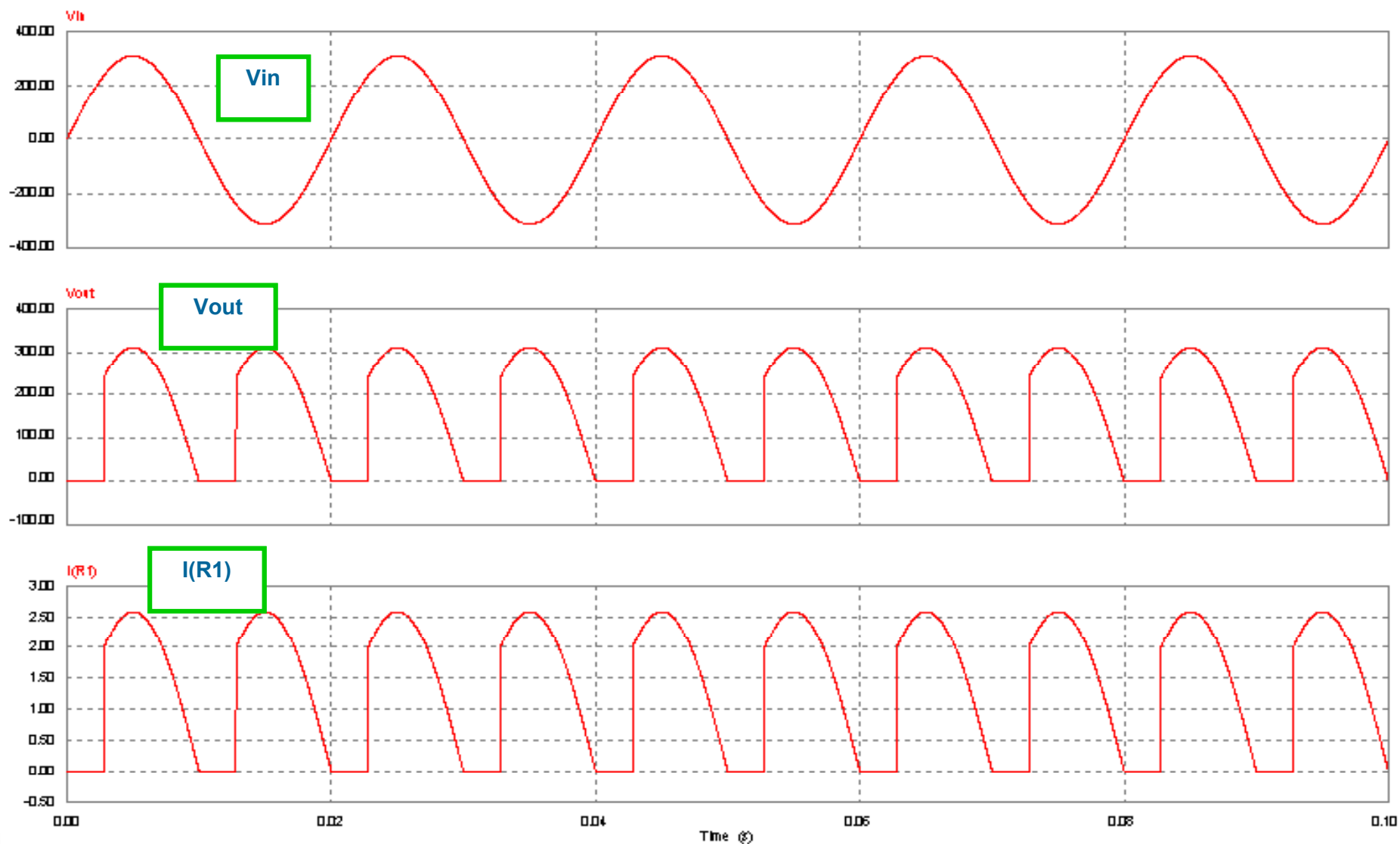
Modo de conducción discontinuo



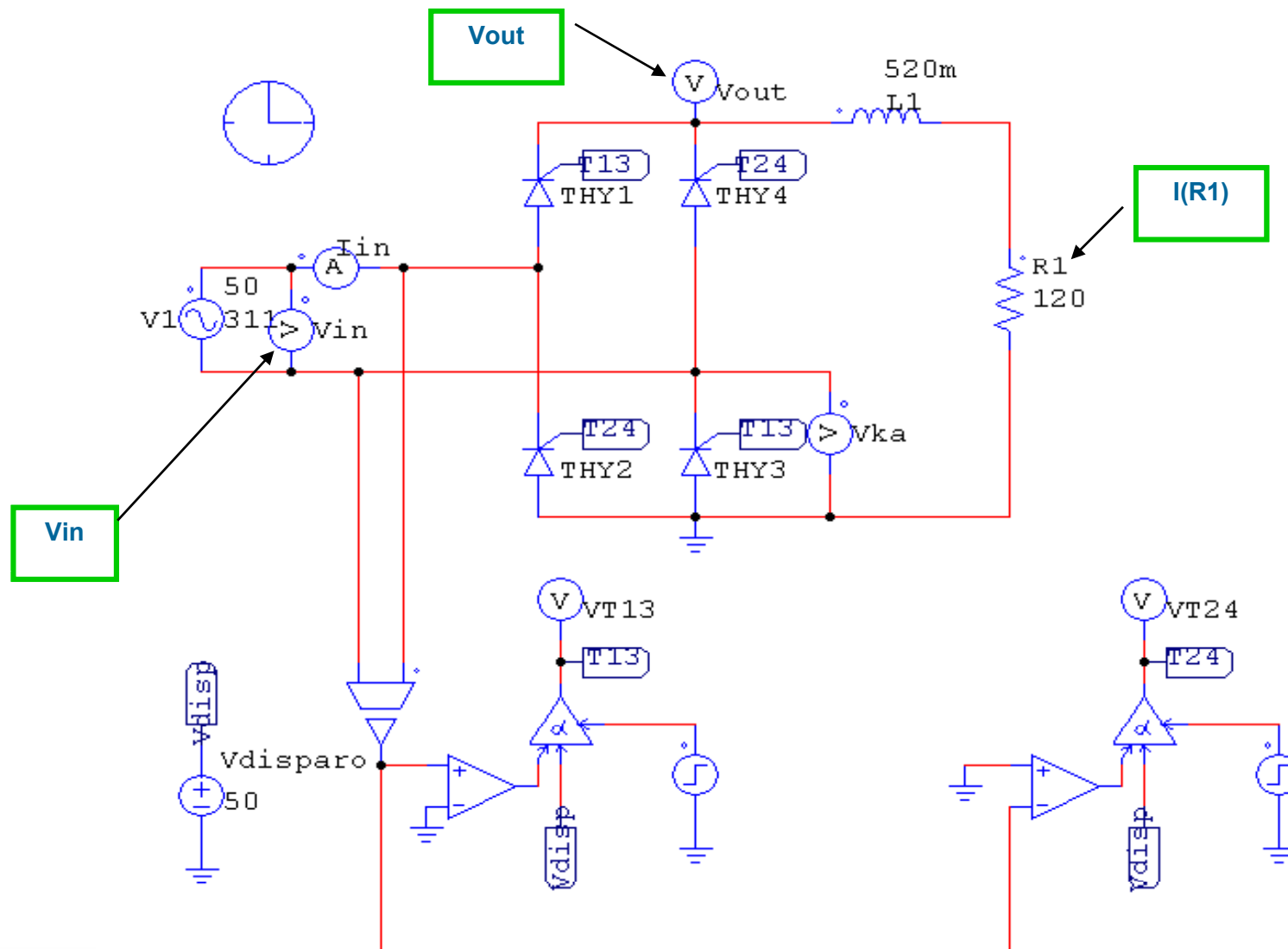
Onda completa, carga R (I)



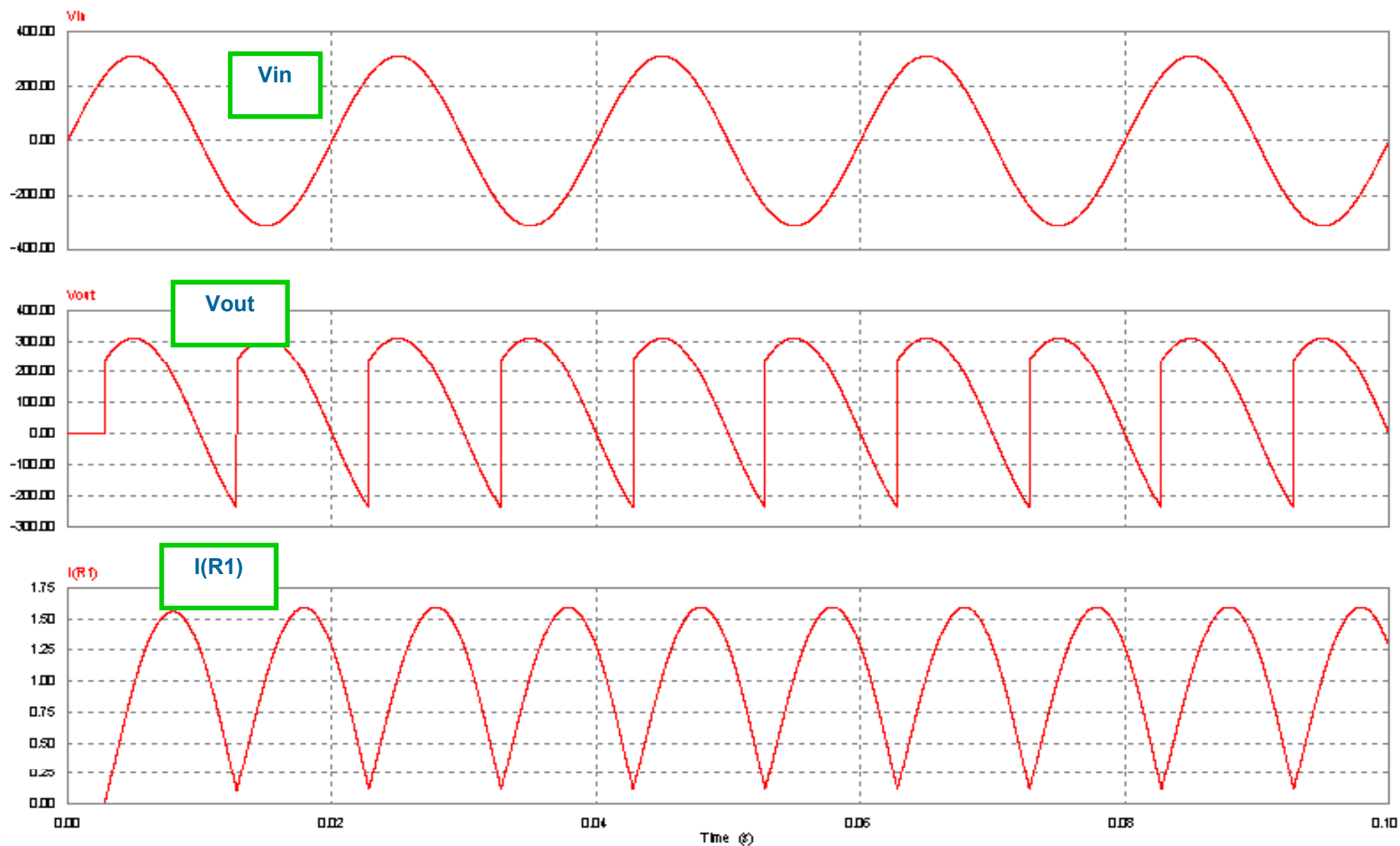
Onda completa, carga R (II)



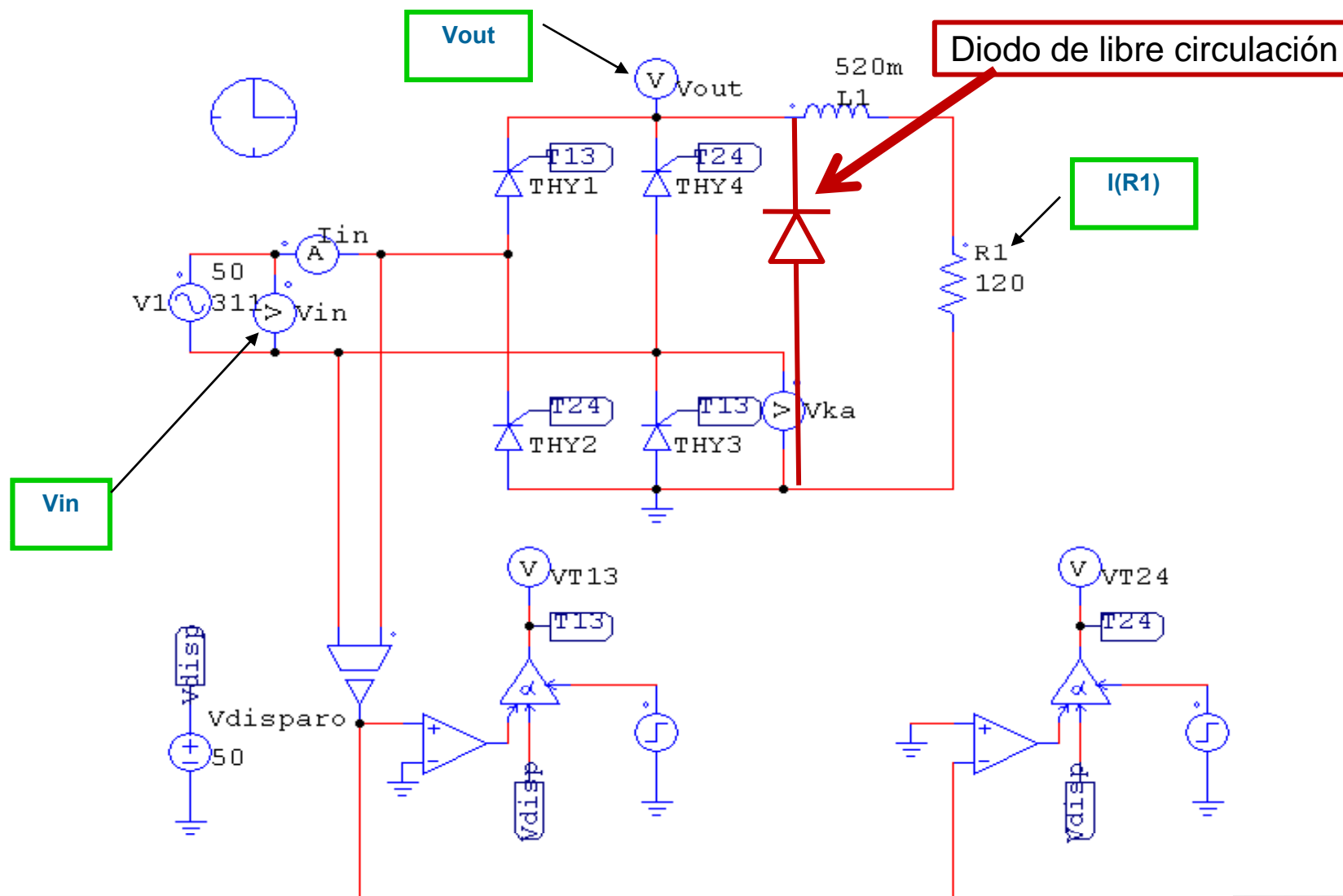
Onda completa, carga RL (I)



Onda completa, carga RL (II)



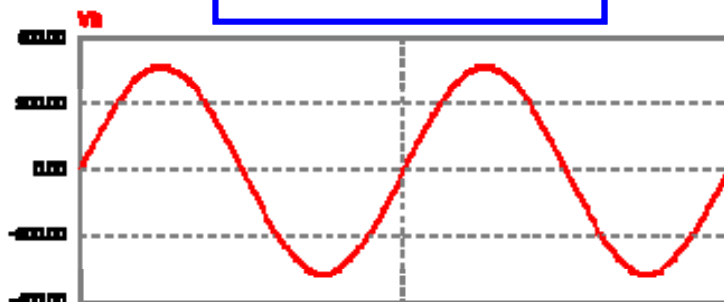
Onda completa, semicontrolado, carga RL (I)



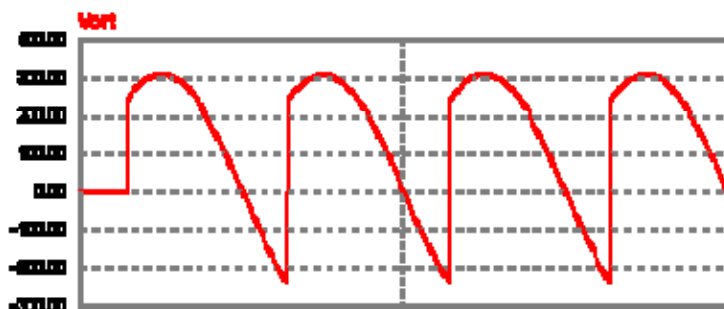
Comparación puente completo controlado y semicontrolado con carga RL



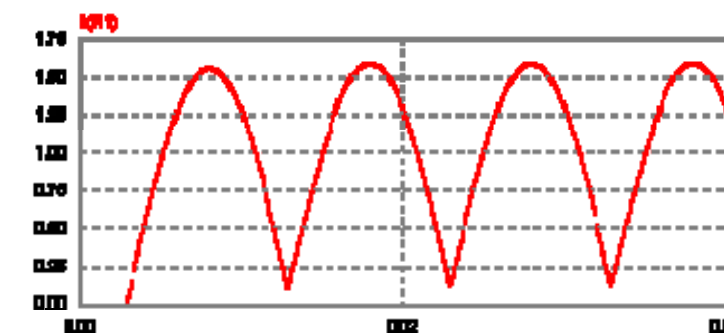
CONTROLADO



Vin

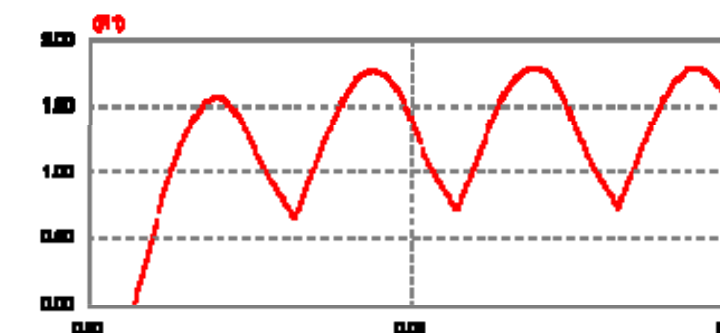
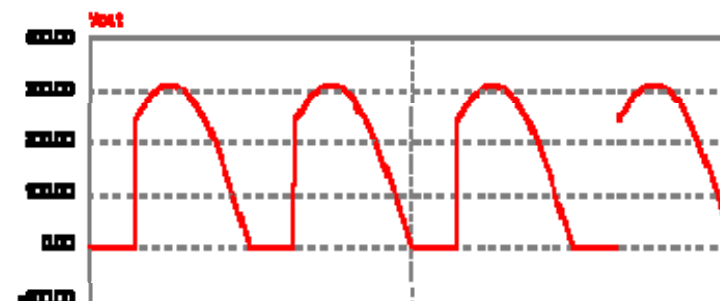
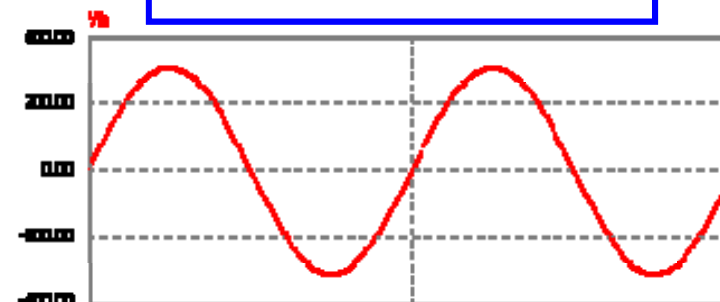


Vout

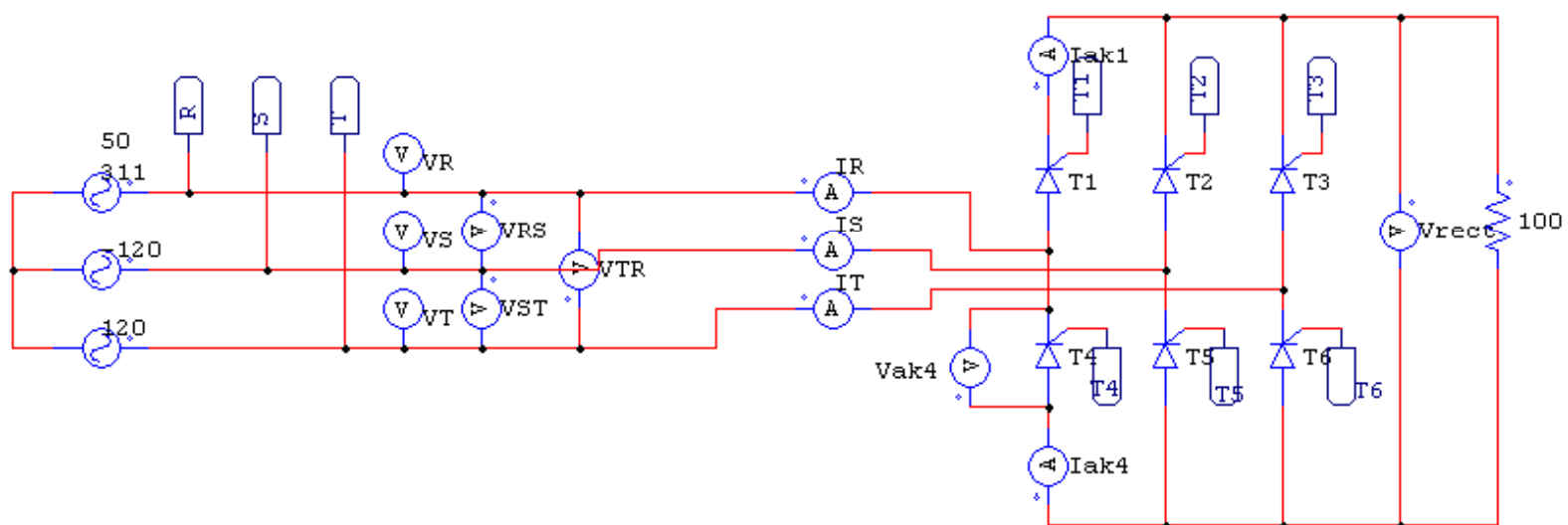


I(R1)

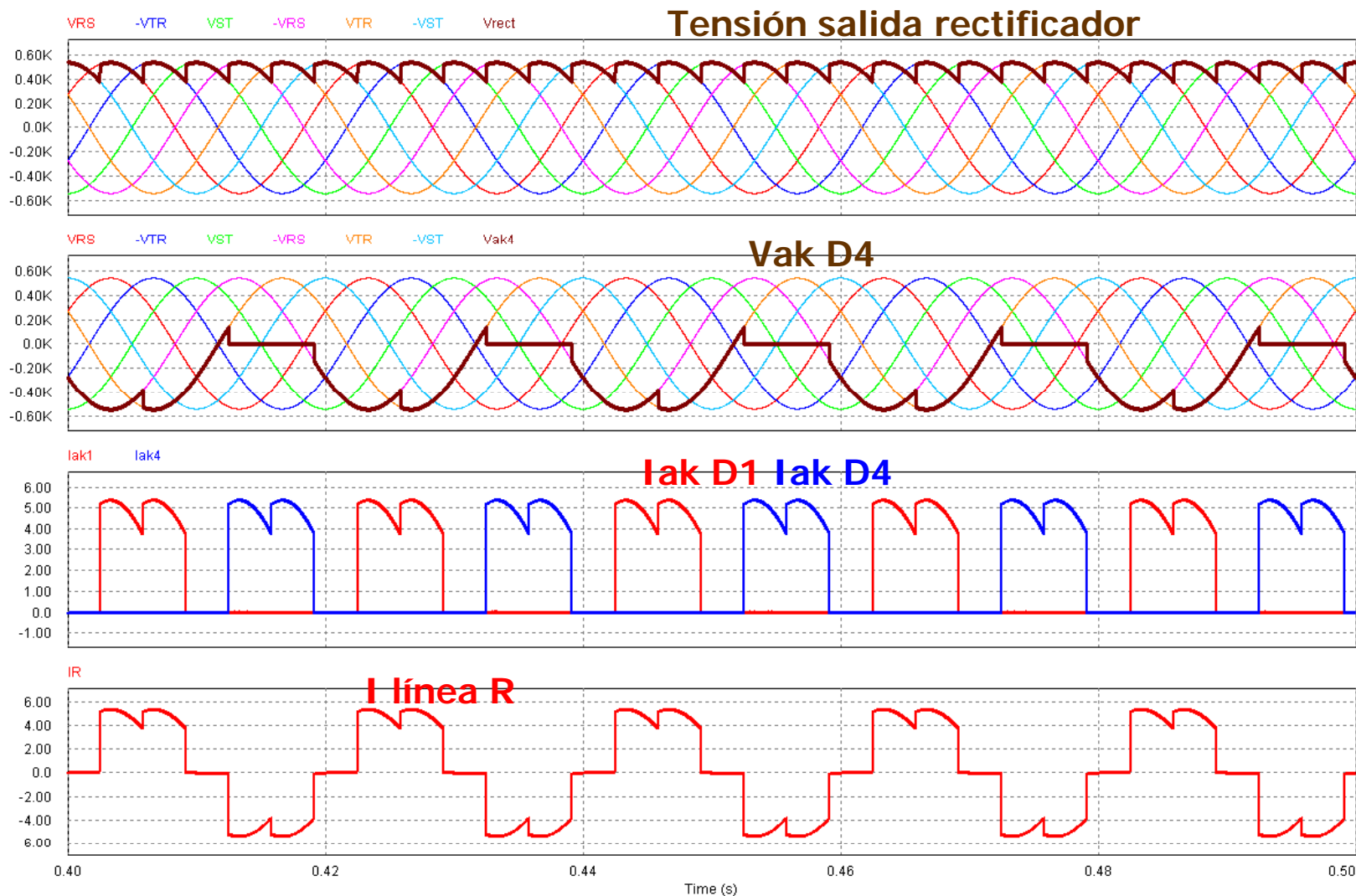
SEMICONTROLADO



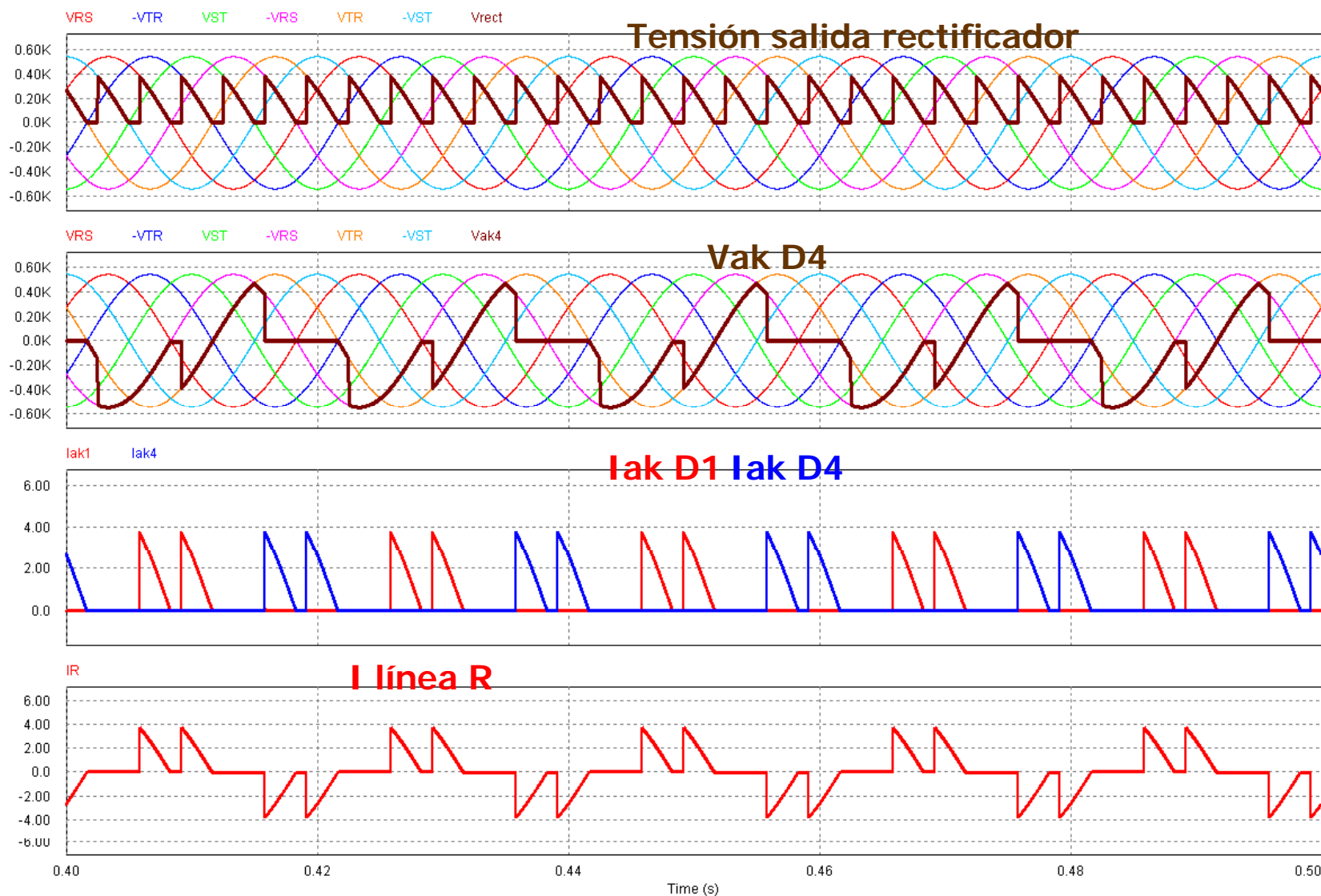
Trifásico, onda completa, carga R



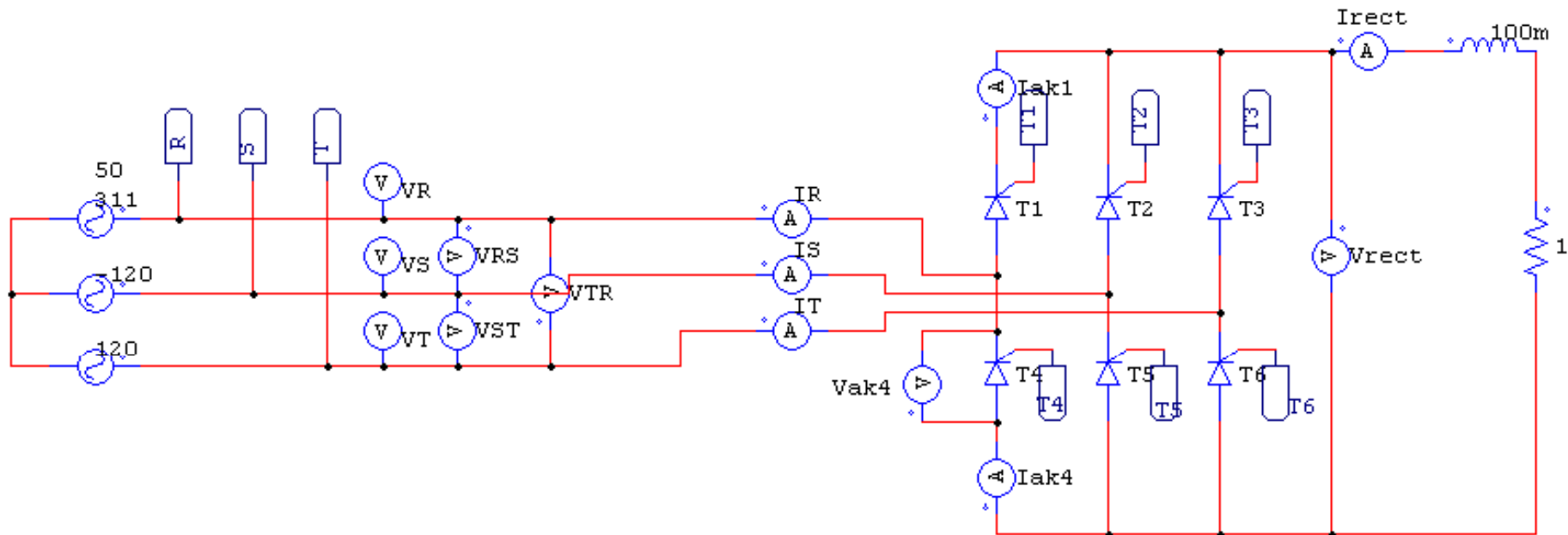
Trifásico, onda completa, carga R $\alpha=15^\circ$



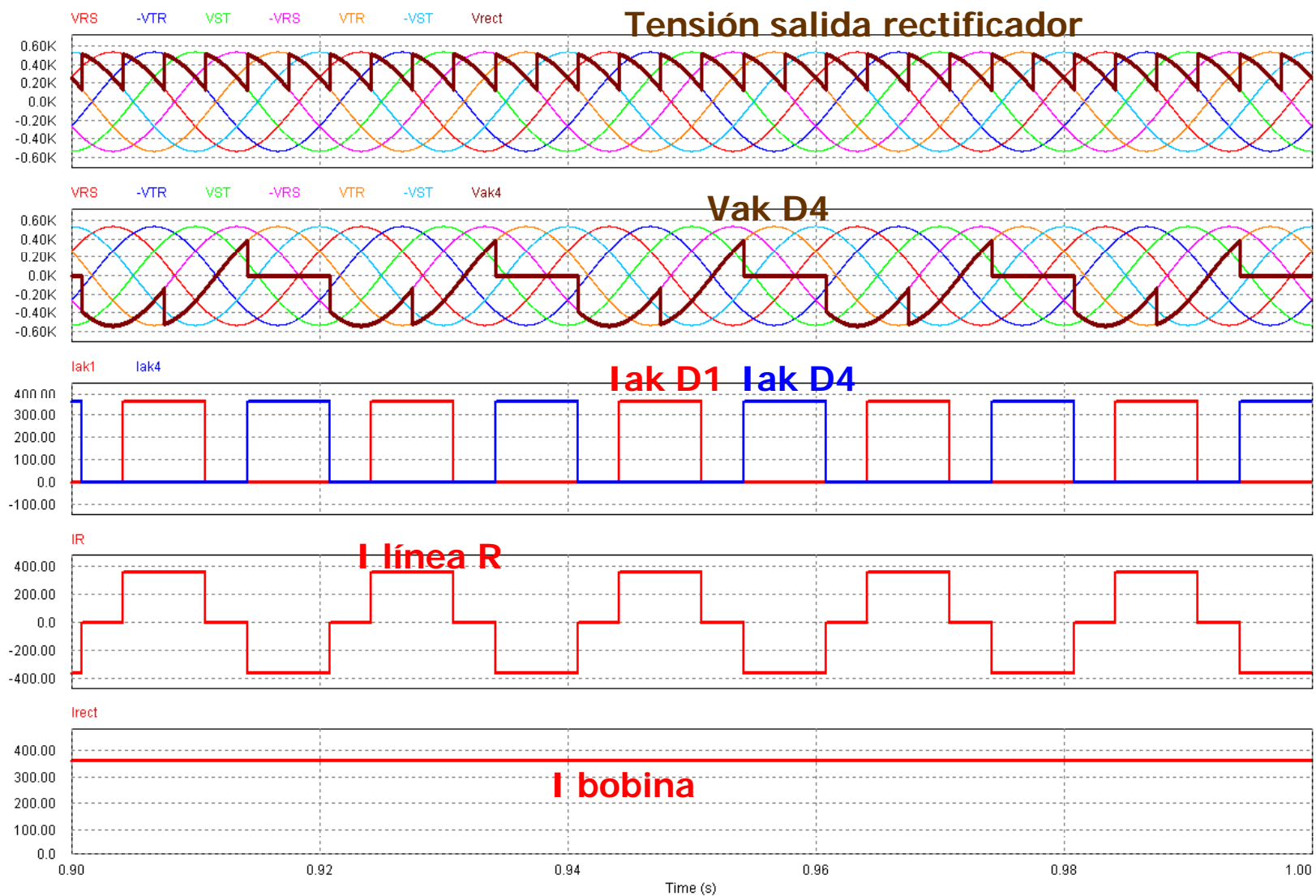
Trifásico, onda completa, carga R $\alpha=75^\circ$



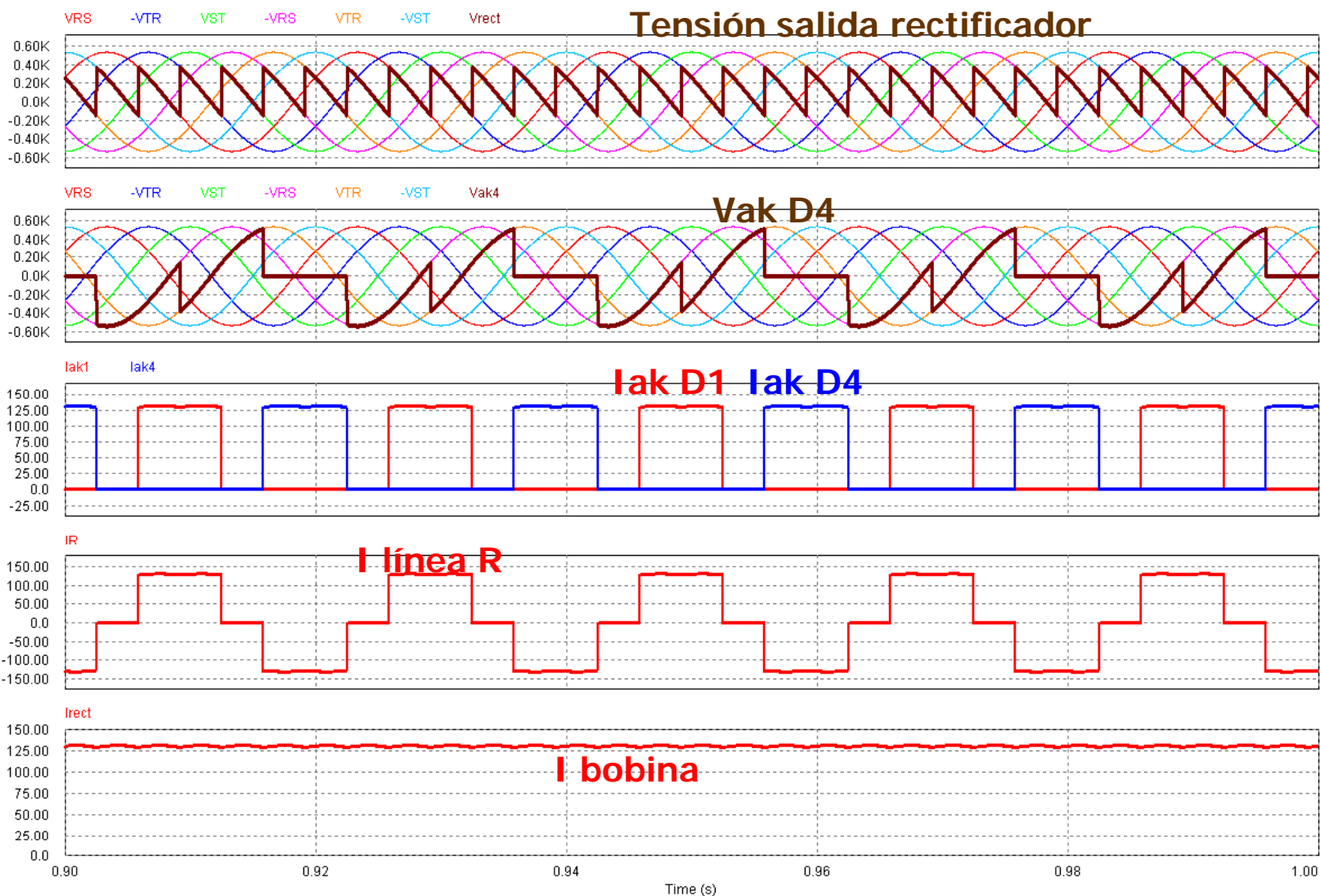
Trifásico, onda completa, carga RL



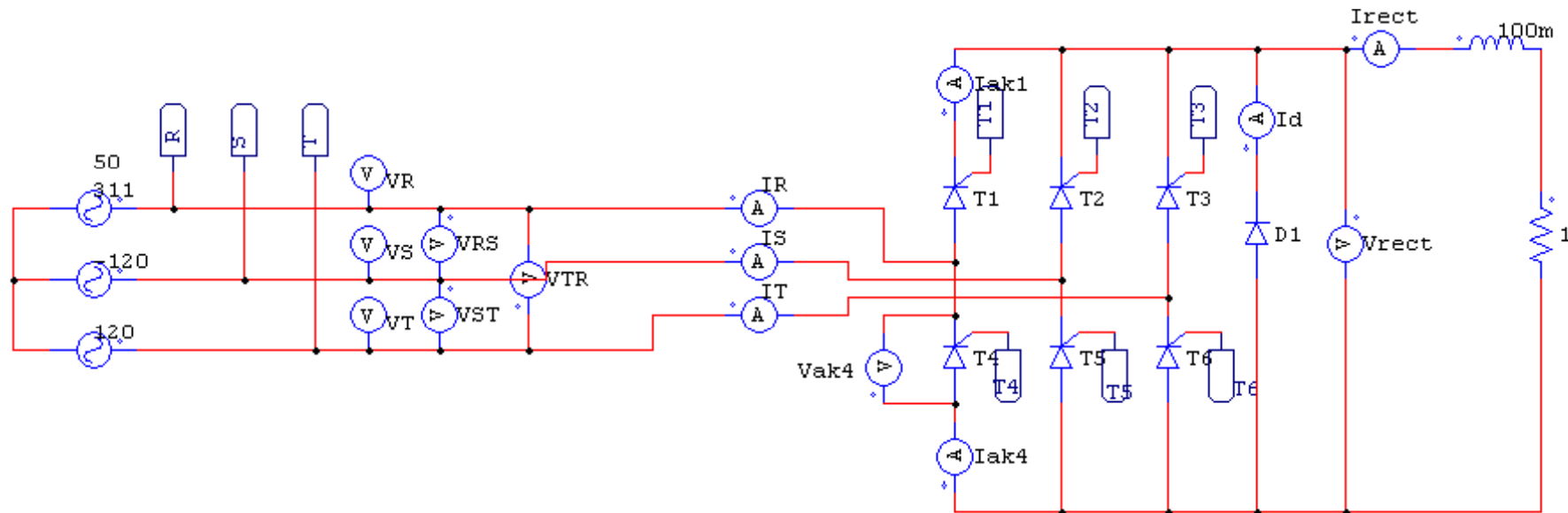
Trifásico, onda completa, carga RL $\alpha=45^\circ$



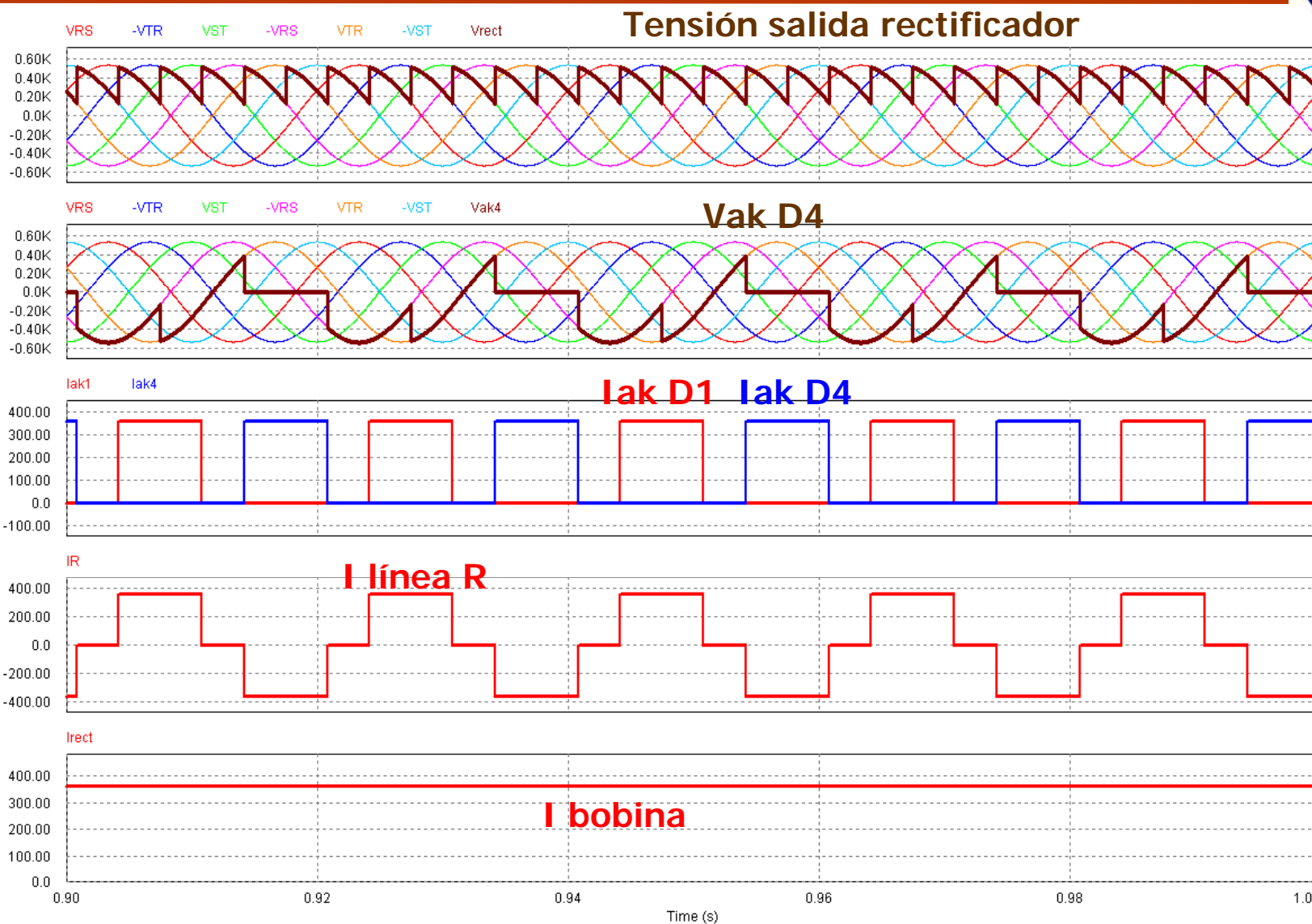
Trifásico, onda completa, carga RL, $\alpha=75^\circ$



Trifásico, onda completa, carga RL con DLC



Trifásico, onda completa, carga RL+DLC, $\alpha=45^\circ$



Trifásico, onda completa, carga RL+DLC, $\alpha=75^\circ$

