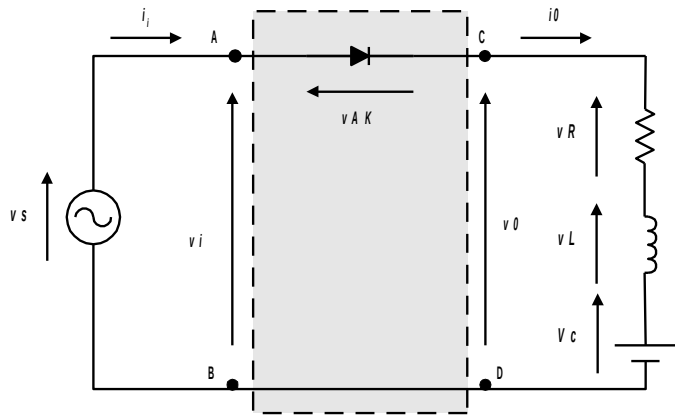


RETIFICADORES MONOFÁSICOS DE MEIA-ONDA

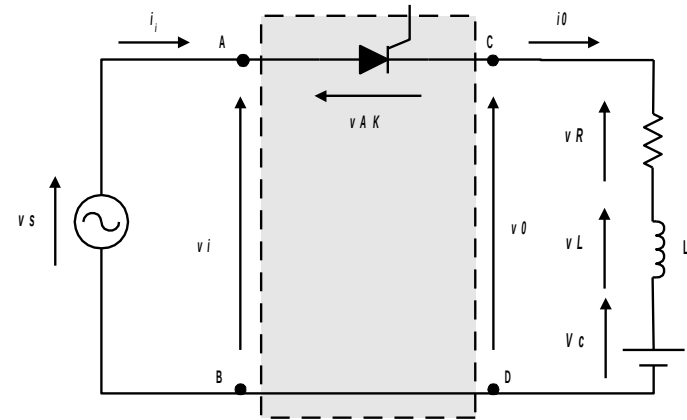
PARTE II

Prof. Azauri A. de Oliveira Jr.

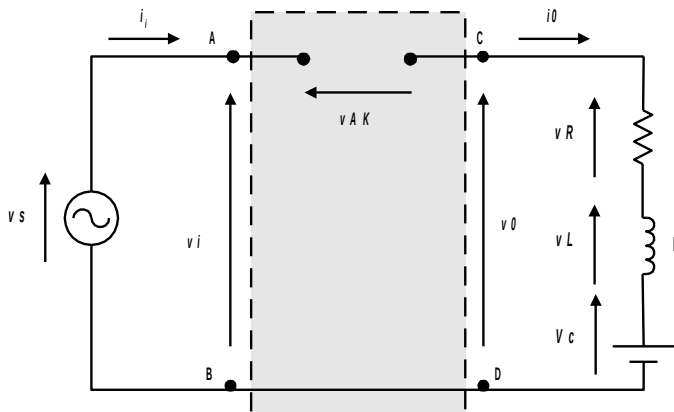
RETIFICADOR MONOFÁSICO DE MEIA-ONDA (CARGA COM FEM)



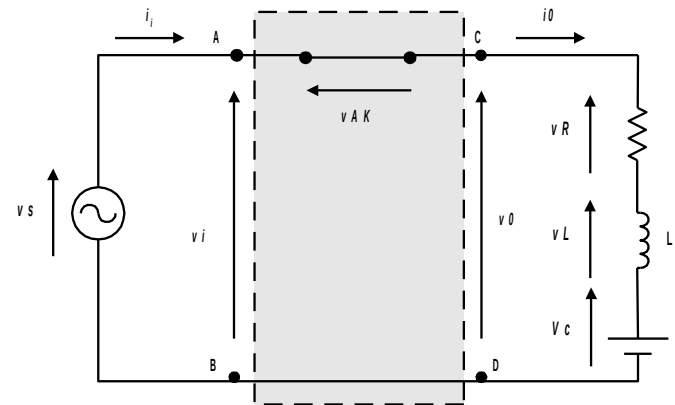
RETIFICADOR NÃO CONTROLADO



RETIFICADOR CONTROLADO

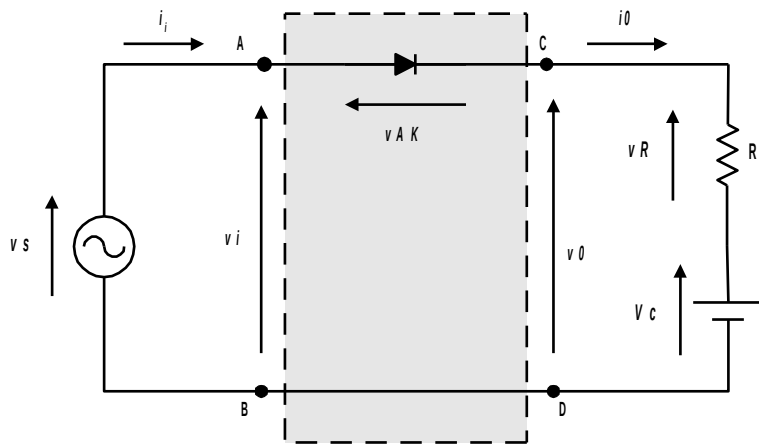


DIODO (OU SCR) NO CORTE

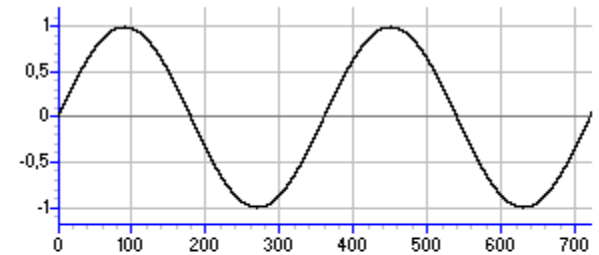


DIODO (OU SCR) EM CONDUÇÃO

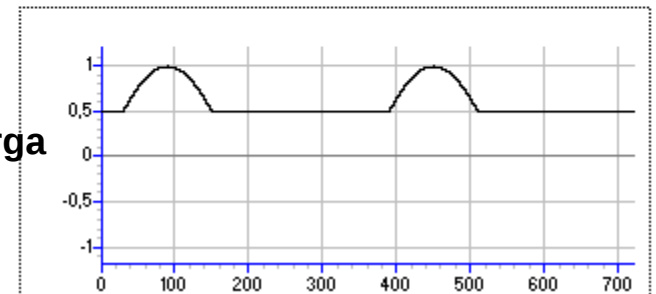
RETIFICADOR NÃO CONTROLADO – CARGA R-FEM (FORMAS DE ONDA)



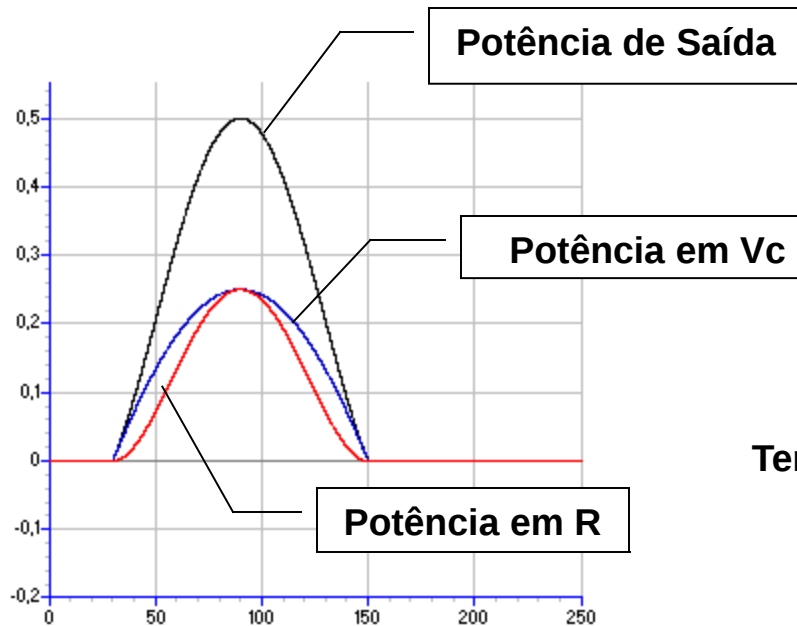
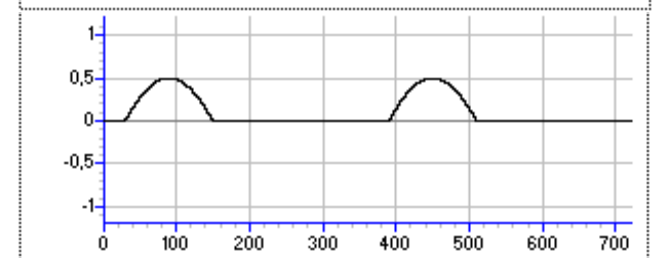
Tensão da Fonte



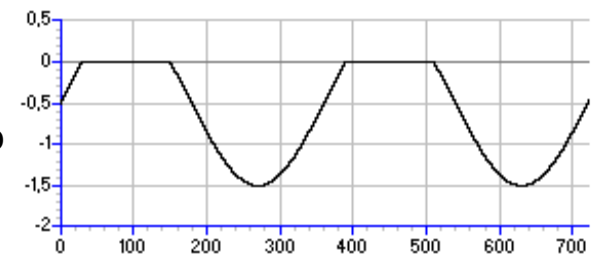
Tensão da Carga



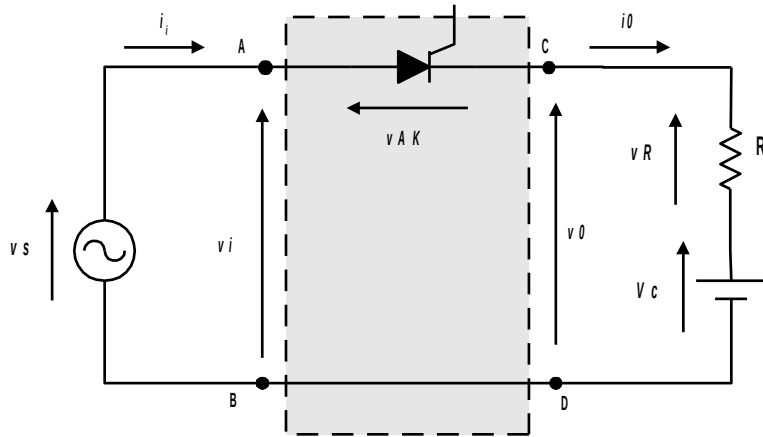
Corrente



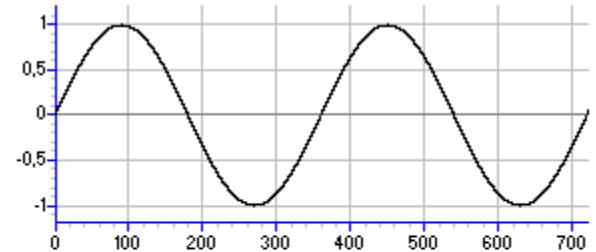
Tensão no Diodo



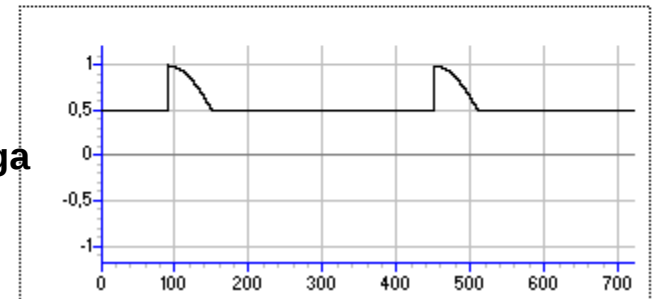
RETIFICADOR CONTROLADO – CARGA R-FEM (FORMAS DE ONDA)



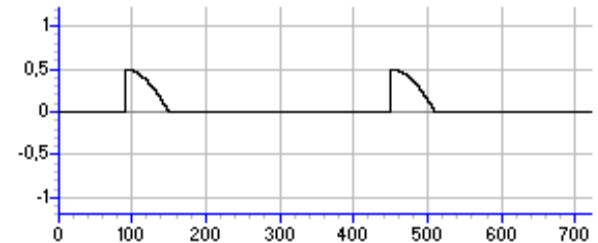
Tensão da Fonte



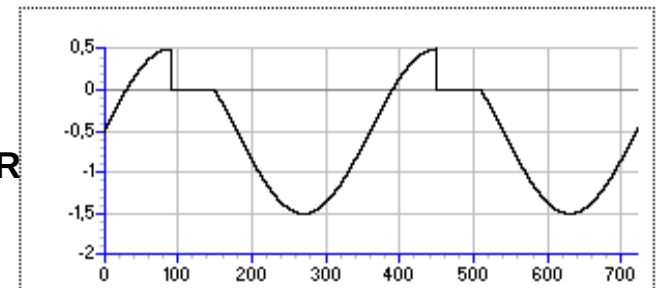
Tensão da Carga



Corrente



Tensão no SCR



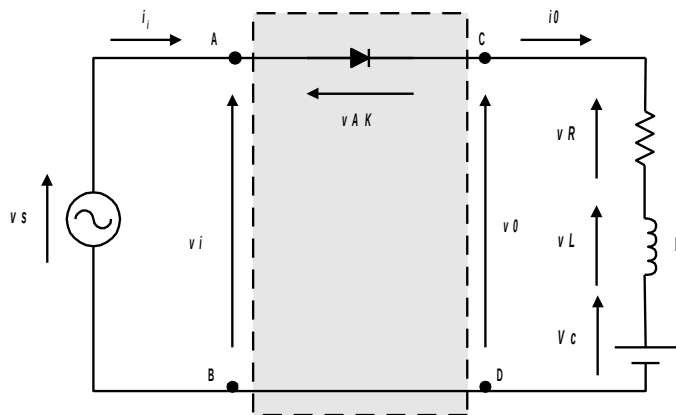
Potência de Saída

Potência em V_c

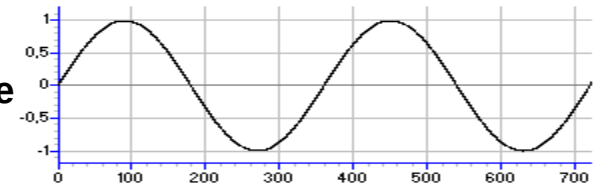
Potência em R



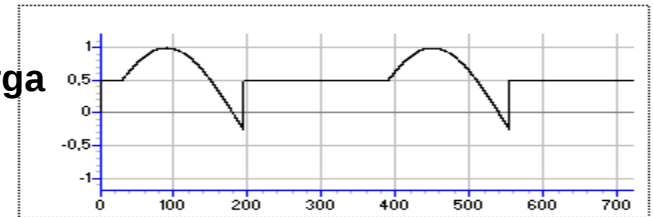
RETIFICADOR NÃO CONTROLADO – CARGA RL-FEM (FORMAS DE ONDA)



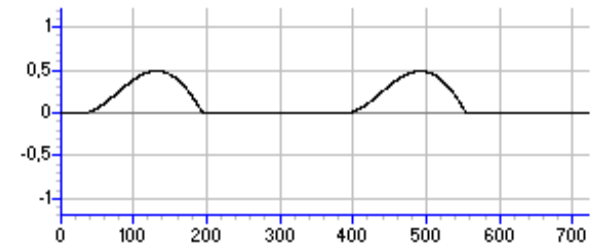
Tensão da Fonte



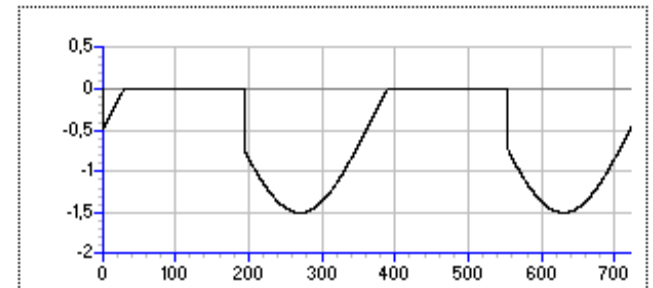
Tensão da Carga



Corrente



Tensão no Diodo

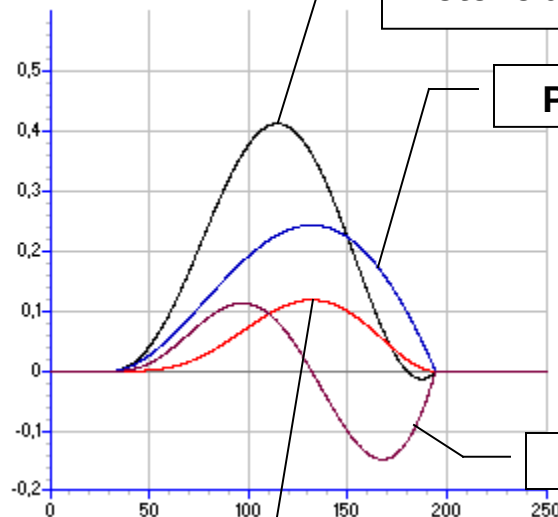


Potência de Saída

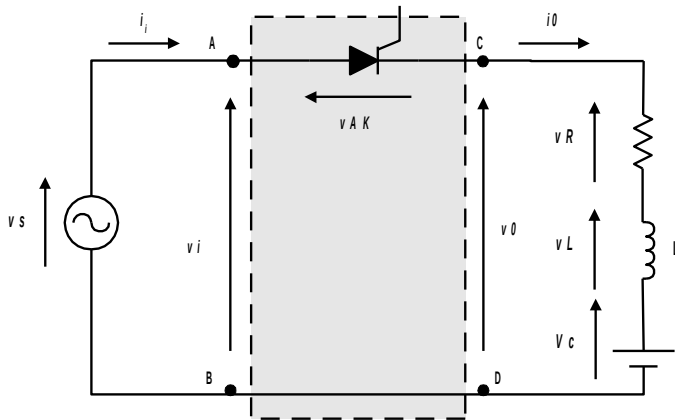
Potência em V_c

Potência em L

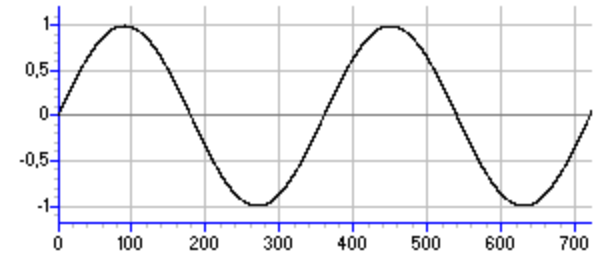
Potência em R



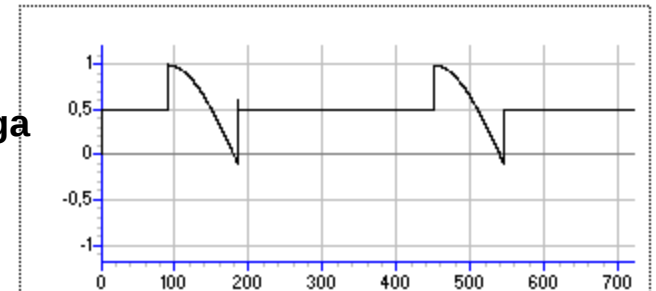
RETIFICADOR CONTROLADO – CARGA RL-FEM (FORMAS DE ONDA)



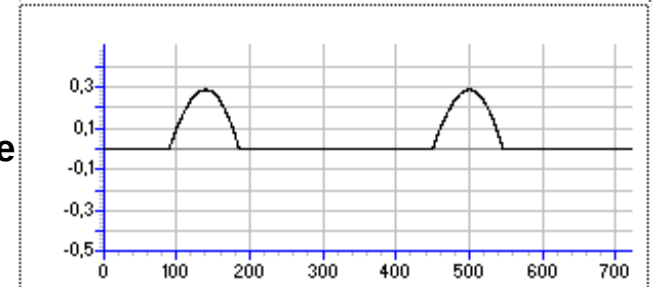
Tensão da Fonte



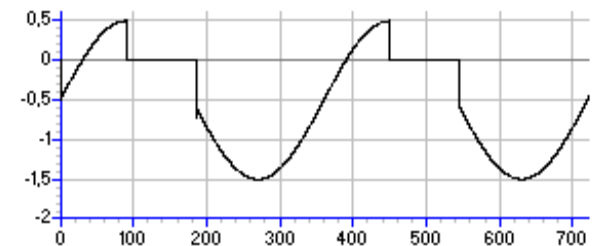
Tensão da Carga



Corrente



Tensão no SCR

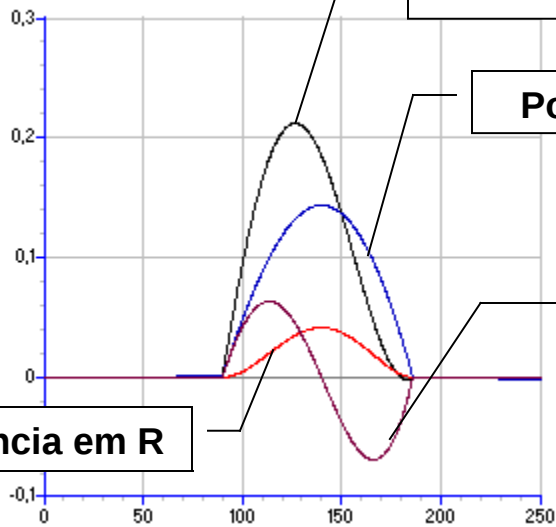


Potência de Saída

Potência em V_c

Potência em L

Potência em R

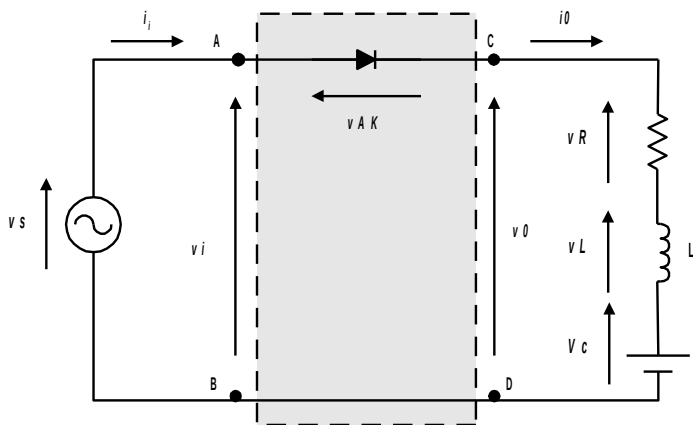


Retificadores Monofásicos de Meia-Onda

Curvas de Projeto

RETIFICADOR MONOFÁSICO DE MEIA-ONDA NÃO CONTROLADO

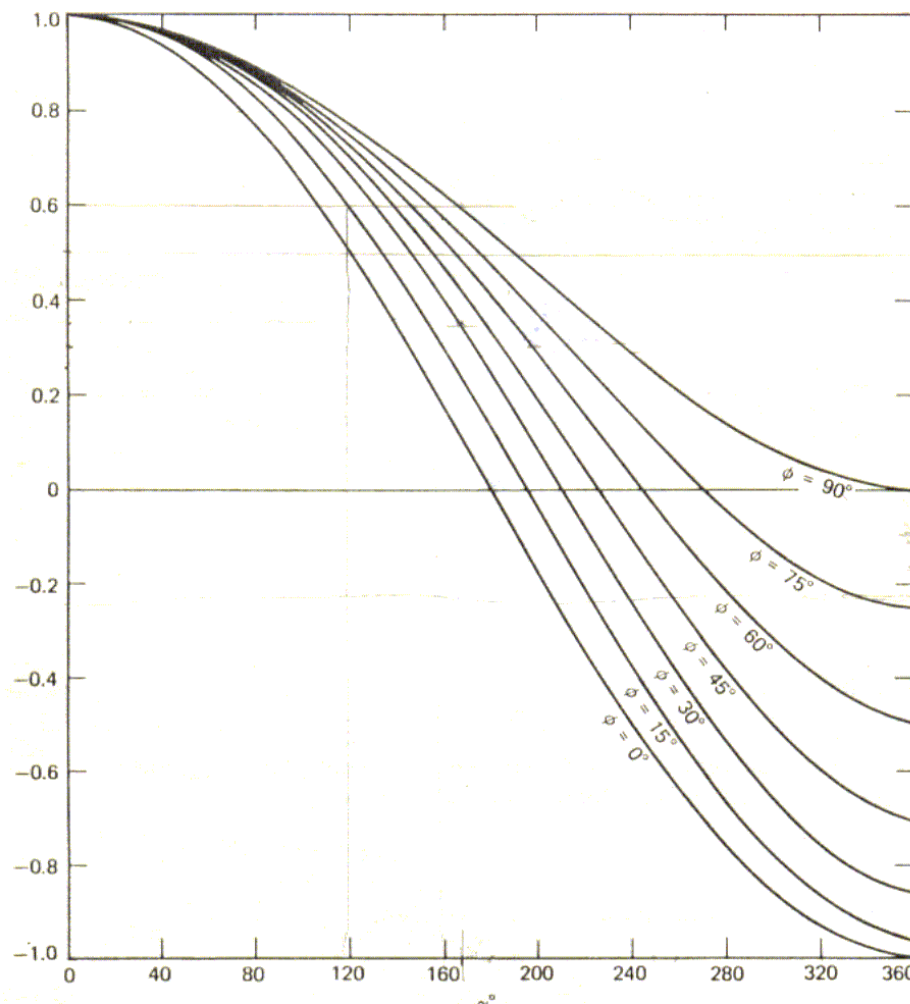
Ângulo de Condução – Carga RL+fem



$$\frac{(m / \cos \phi) - \operatorname{sen}(\eta + \gamma - \phi)}{(m / \cos \phi) - \operatorname{sen}(\eta - \phi)} = e^{-\gamma / \tan \phi}$$

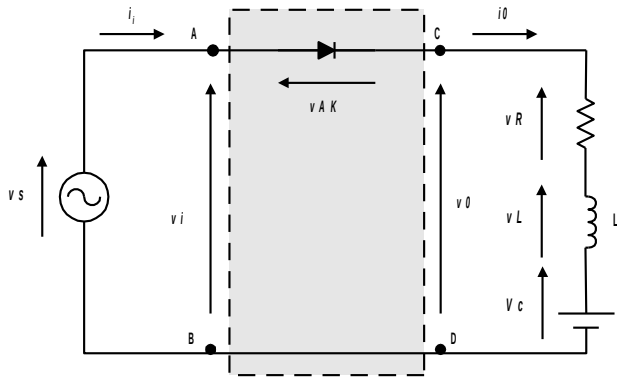
$$\gamma = \beta - \eta$$

$$\eta = \operatorname{arcsen}(m) = \operatorname{arcsen}\left(\frac{V_c}{\sqrt{2} \cdot V}\right)$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA NÃO CONTROLADO

Correntes média normalizadas – Carga RL+fem

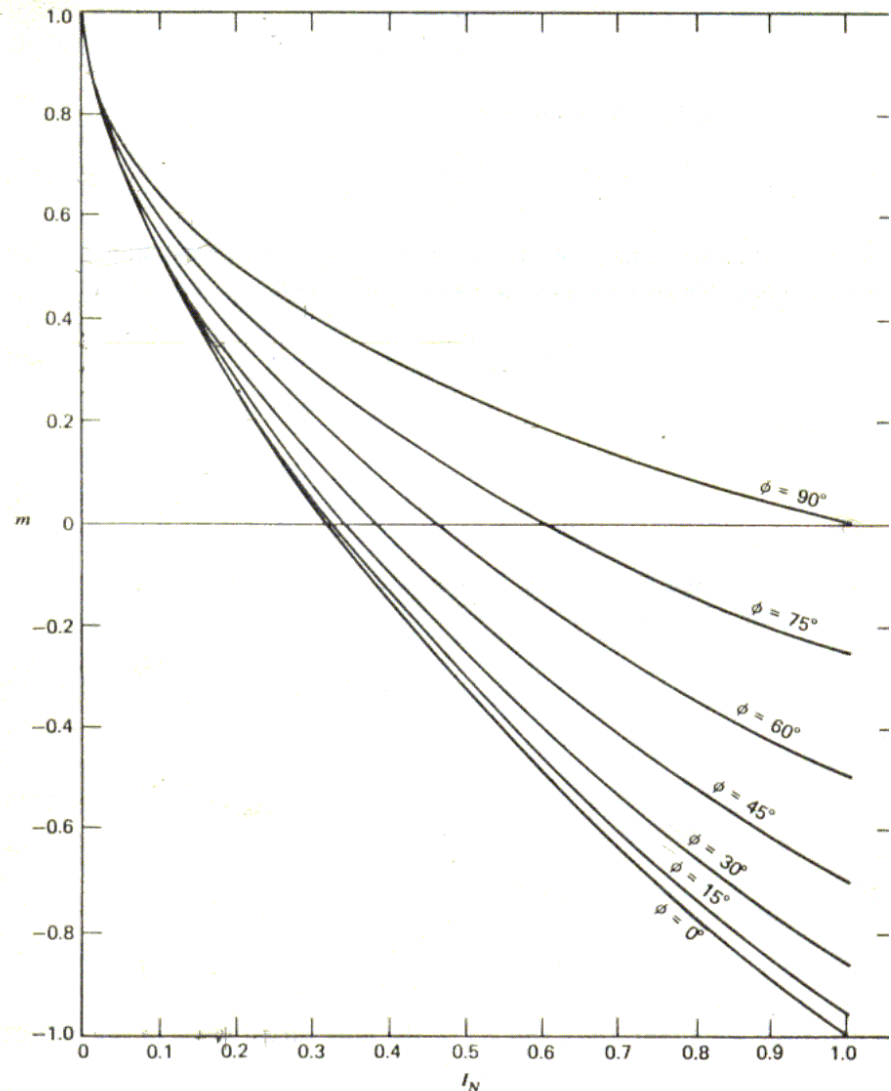


$$i_N = \sin(\omega.t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{-\omega.t / \tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\eta - \phi) \right] . e^{\eta / \tan \phi}$$

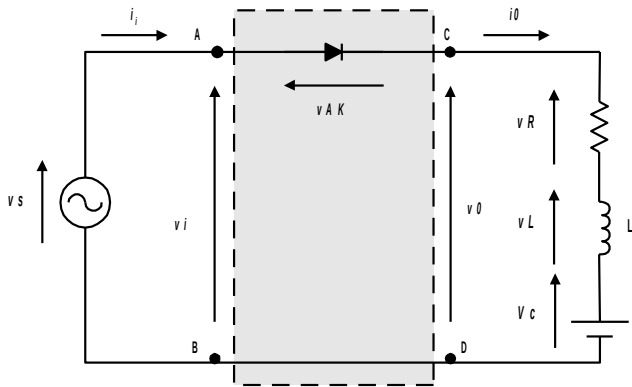
$$i_N = i(\omega.t) / I_{base} \quad ; \quad I_{base} = \sqrt{2}.V / Z$$

$$I_N = \frac{1}{2.\pi} \int_{\eta}^{\beta=\gamma+\eta} i_N . d\omega t$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA NÃO CONTROLADO

Corrente rms normalizadas – Carga RL+fem

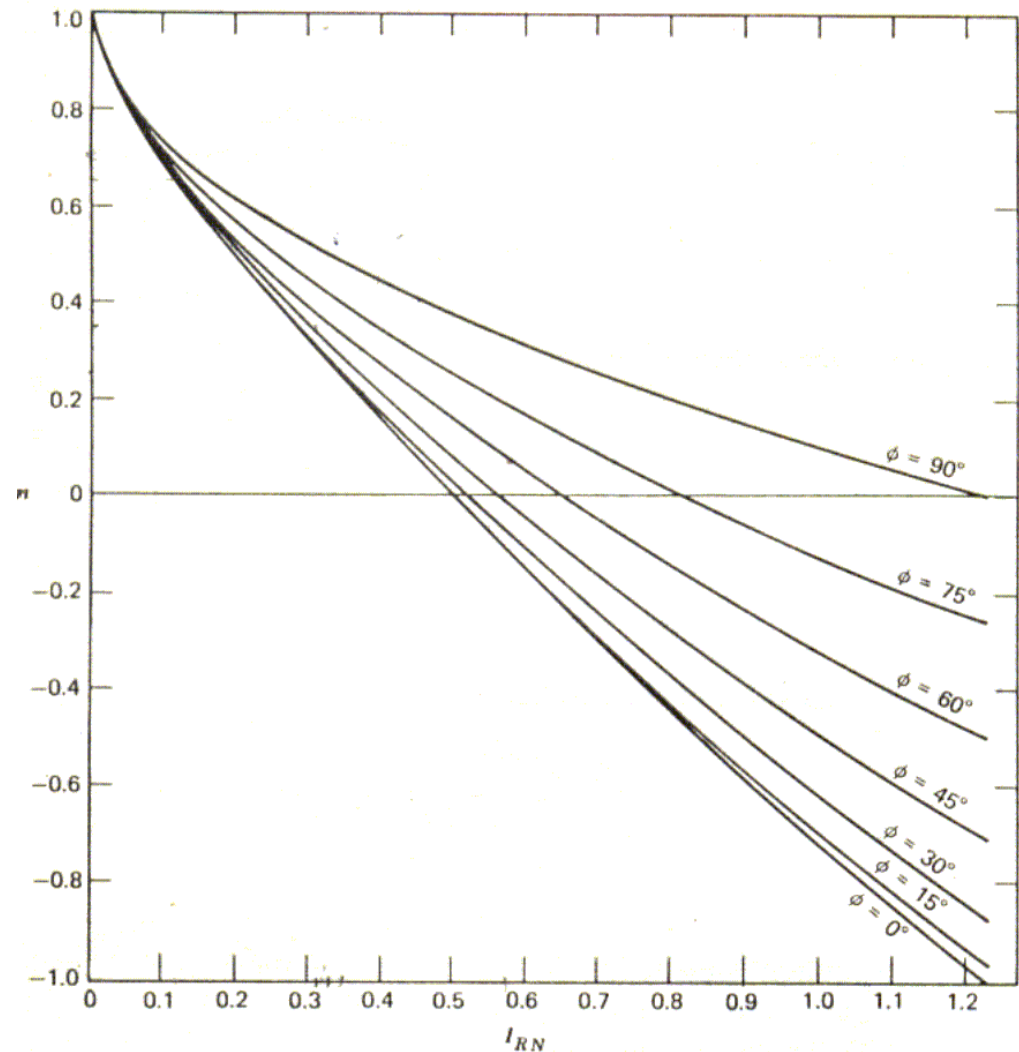


$$i_N = \sin(\omega t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{-\omega t / \tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\eta - \phi) \right] . e^{\eta / \tan \phi}$$

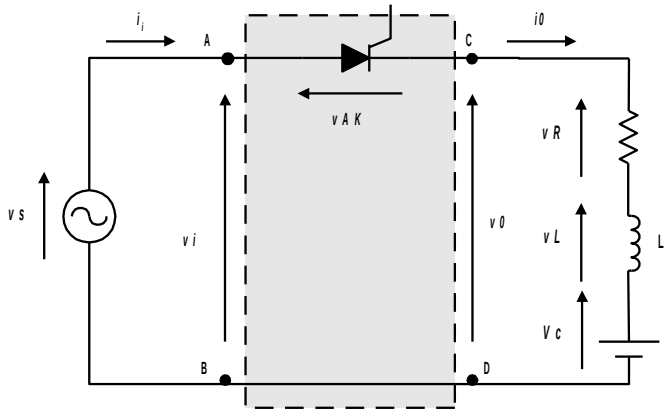
$$i_N = \frac{i(\omega t)}{I_{base}} \quad ; \quad I_{base} = \sqrt{2} . V / Z$$

$$I_{RN} = \sqrt{\frac{1}{2\pi} \int_{\eta}^{\beta = \gamma + \eta} i_N^2 . d\omega t}$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Ângulo de Condução – Carga RL+fem

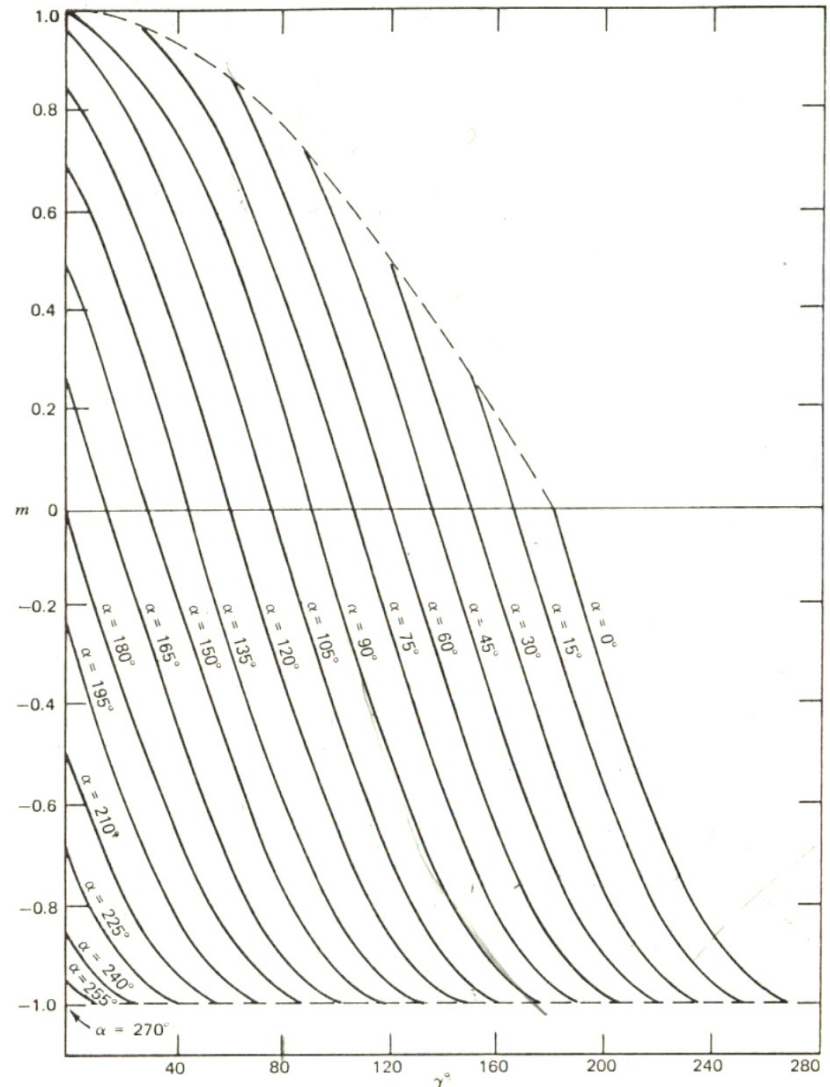


$$\frac{(m / \cos \phi) - \sin(\alpha + \gamma - \phi)}{(m / \cos \phi) - \sin(\alpha - \phi)} = e^{-\gamma / \tan \phi}$$

$$\gamma = \beta - \alpha$$

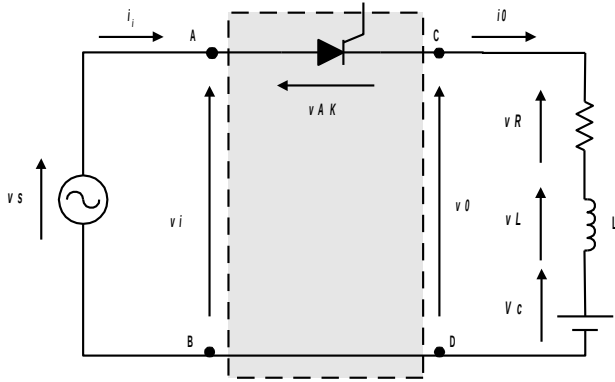
$$\eta = \arcsen(m) = \arcsen\left(\frac{V_c}{\sqrt{2} \cdot V}\right)$$

$$\phi = 0^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Corrente Média Normalizada – Carga RL+fem

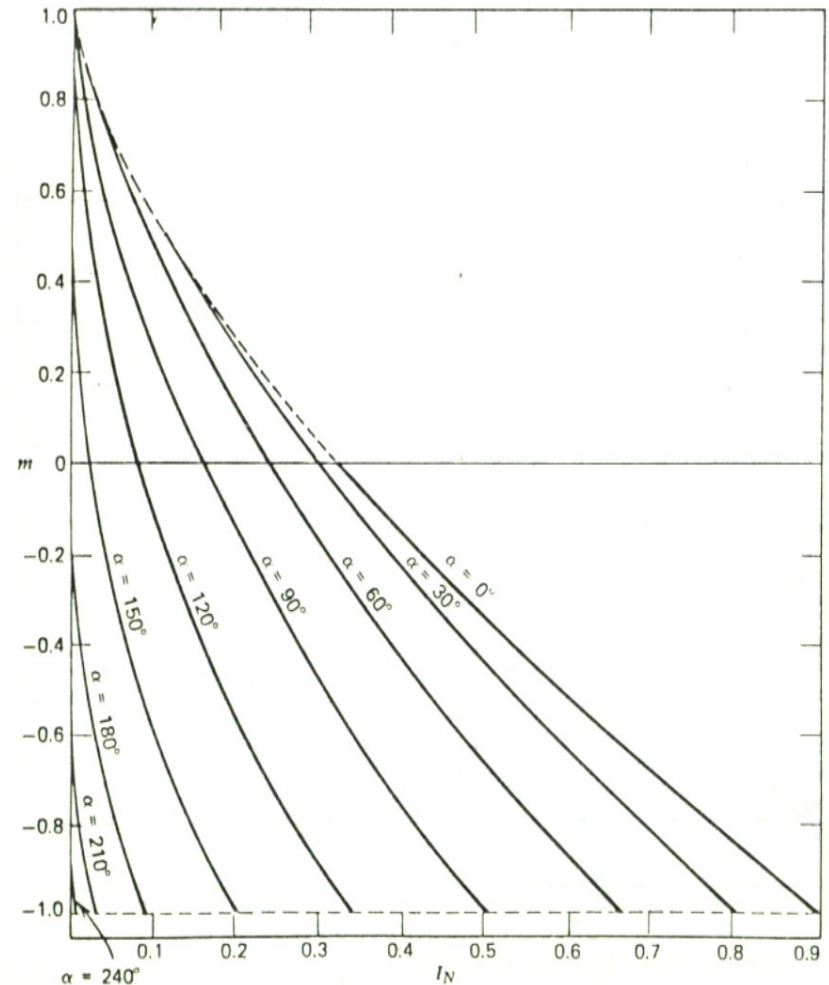


$$i_N = \sin(\omega t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{(\alpha - \omega t)/\tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\alpha - \phi) \right]$$

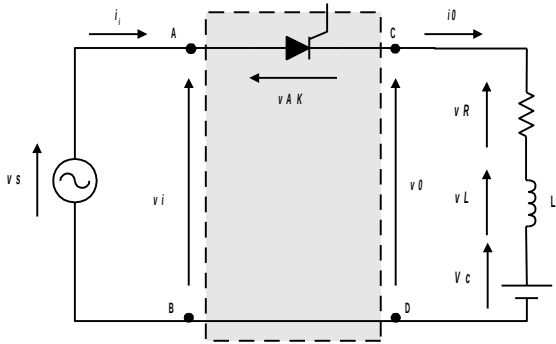
$$i_N = \frac{i(\omega t)}{I_{base}} \quad ; \quad I_{base} = \frac{\sqrt{2}V}{Z}$$

$$I_{RN} = \frac{1}{2\pi} \int_{\alpha}^{\beta=\gamma+\alpha} i_N.d\omega t \quad ; \quad \phi = 0^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Corrente RMS Normalizada – Carga RL+fem

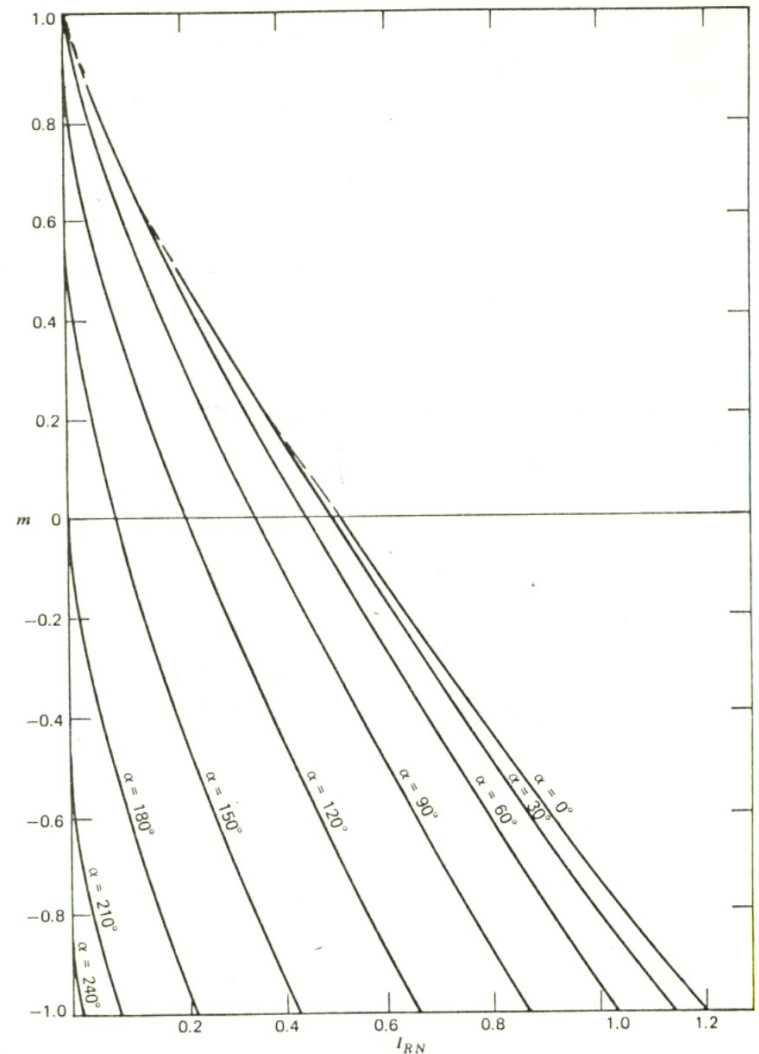


$$i_N = \sin(\omega t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{(\alpha - \omega t) / \tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\alpha - \phi) \right]$$

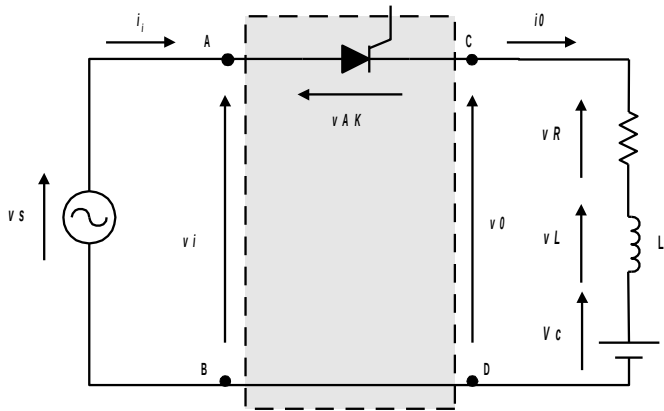
$$i_N = i(\omega t) / I_{base} \quad ; \quad I_{base} = \sqrt{2}V / Z$$

$$I_{RN} = \sqrt{\frac{1}{2\pi} \int_{\alpha}^{\beta = \gamma + \alpha} i_N^2 \cdot d\omega t} \quad ; \quad \phi = 0^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Ângulo de Condução – Carga RL+fem

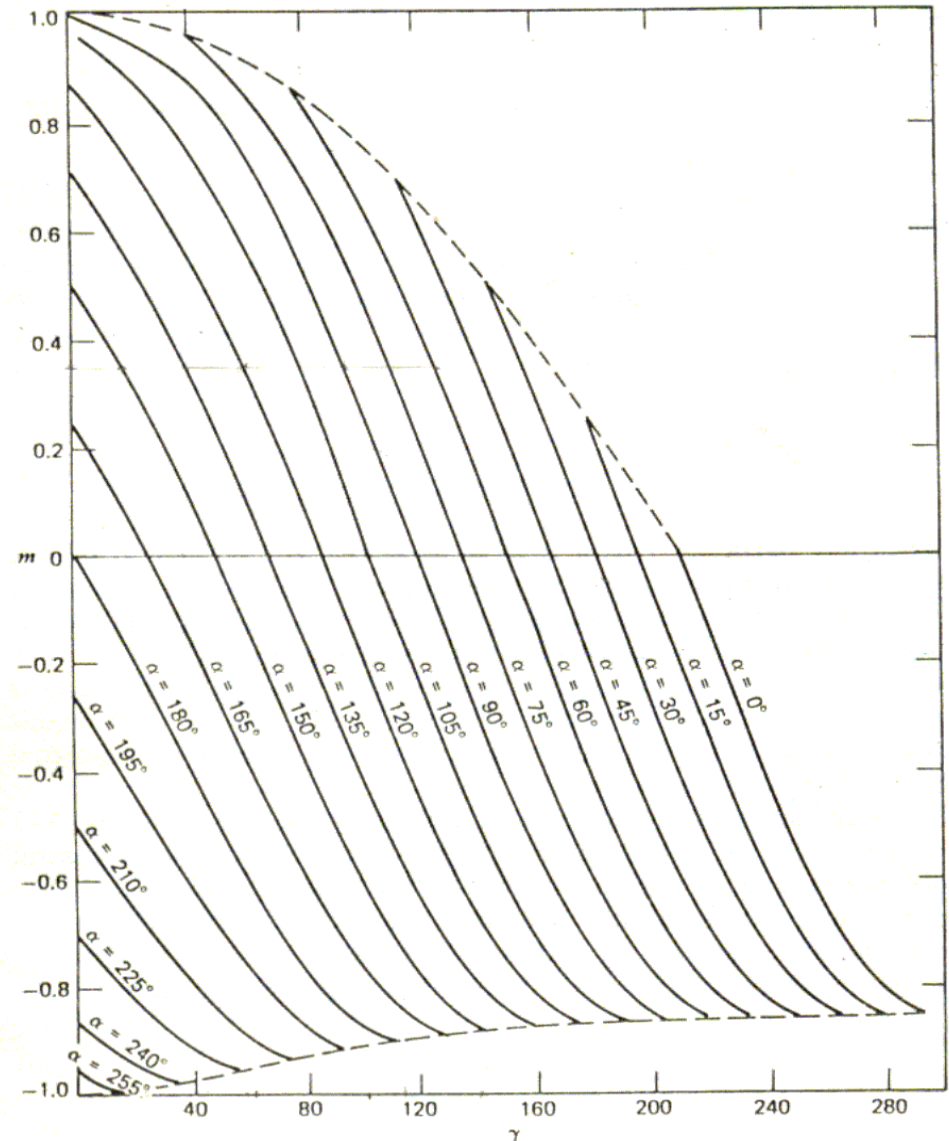


$$\frac{(m / \cos \phi) - \sin(\alpha + \gamma - \phi)}{(m / \cos \phi) - \sin(\alpha - \phi)} = e^{-\gamma / \tan \phi}$$

$$\gamma = \beta - \alpha$$

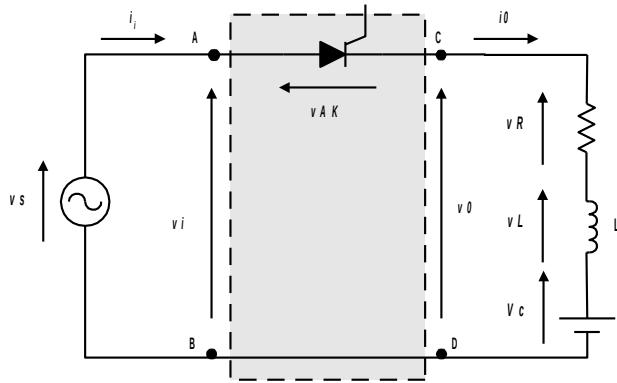
$$\eta = \arcsen(m) = \arcsen\left(\frac{V_c}{\sqrt{2} \cdot V}\right)$$

$$\phi = 30^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Corrente Média Normalizada – Carga RL+fem

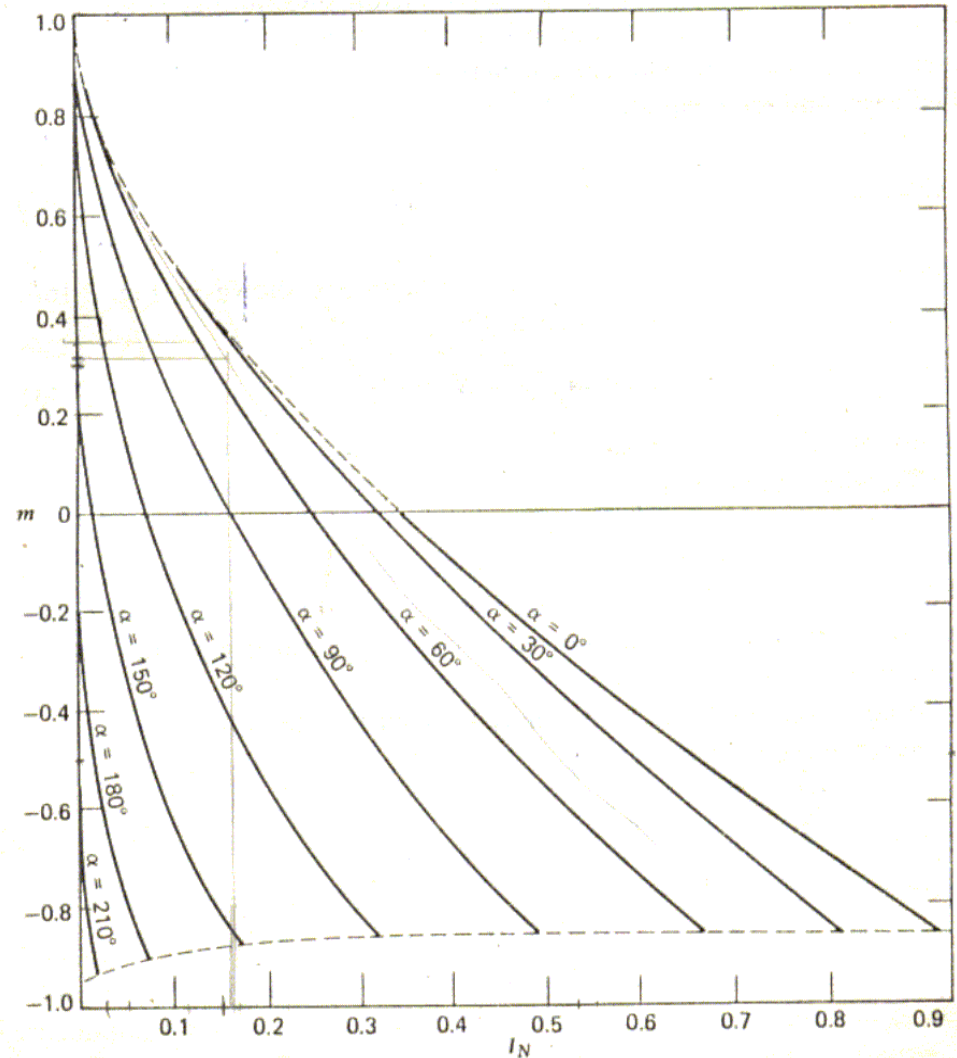


$$i_N = \frac{m}{\cos \phi} \left[\sin(\omega t - \phi) - B e^{(\alpha - \omega t) / \tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\alpha - \phi) \right]$$

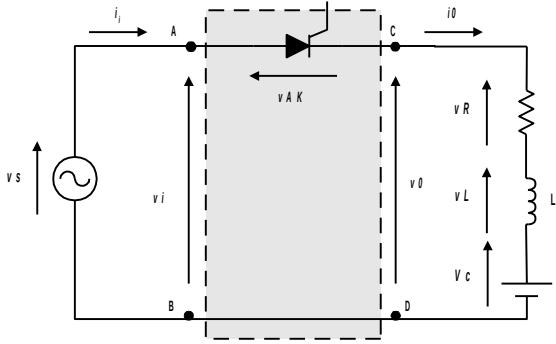
$$i_N = \frac{i(\omega t)}{I_{base}} \quad ; \quad I_{base} = \frac{\sqrt{2} V}{Z}$$

$$I_{RN} = \frac{1}{2\pi} \int_{\alpha}^{\beta = \gamma + \alpha} i_N d\omega t \quad ; \quad \phi = 30^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Corrente RMS Normalizada – Carga RL+fem

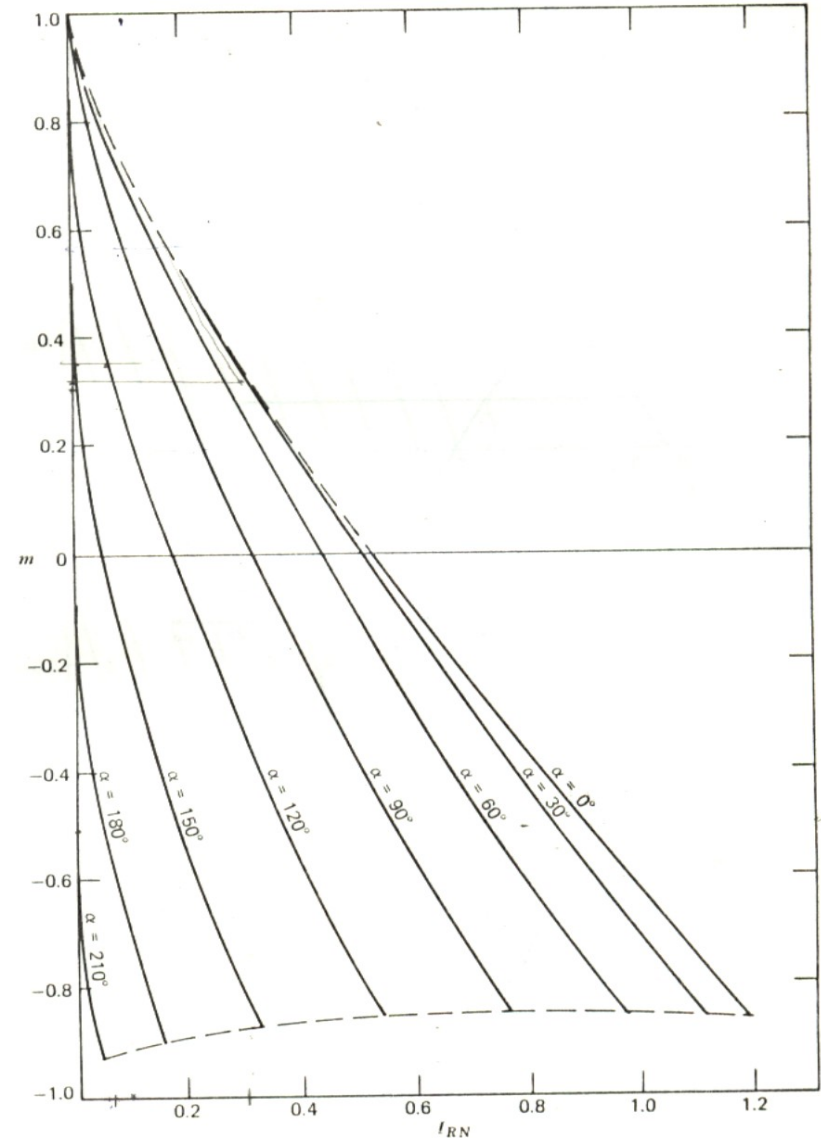


$$i_N = \sin(\omega t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{(\alpha - \omega t) / \tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\alpha - \phi) \right]$$

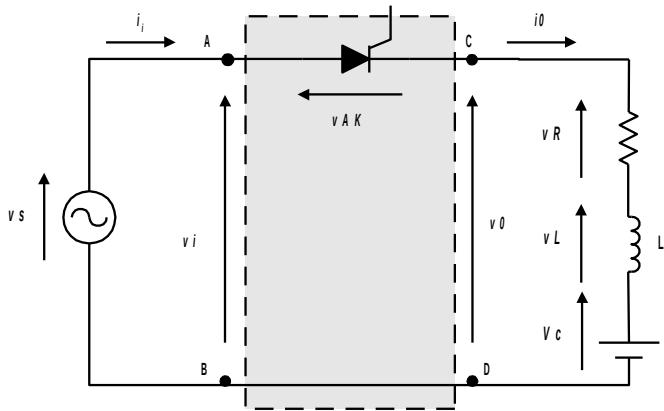
$$i_N = i(\omega t) / I_{base} \quad ; \quad I_{base} = \sqrt{2} V / Z$$

$$I_{RN} = \sqrt{\frac{1}{2\pi} \int_{\alpha}^{\beta = \gamma + \alpha} i_N^2 \cdot d\omega t} \quad ; \quad \phi = 30^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Ângulo de Condução – Carga RL+fem

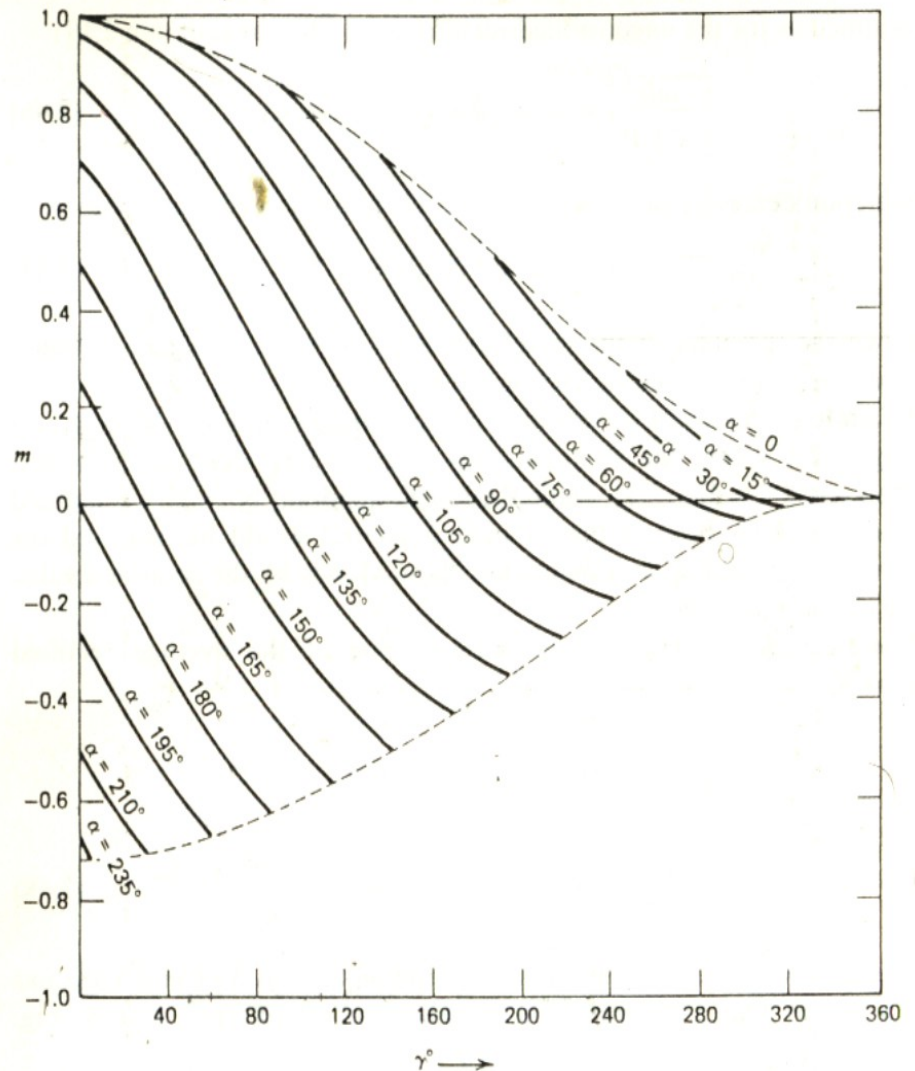


$$\frac{(m / \cos \phi) - \sin(\alpha + \gamma - \phi)}{(m / \cos \phi) - \sin(\alpha - \phi)} = e^{-\gamma / \tan \phi}$$

$$\gamma = \beta - \alpha$$

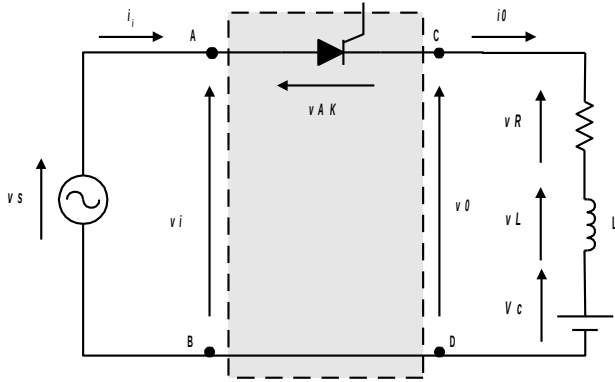
$$\eta = \arcsen(m) = \arcsen\left(\frac{V_c}{\sqrt{2} \cdot V}\right)$$

$$\phi = 90^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Corrente Média Normalizada – Carga RL+fem

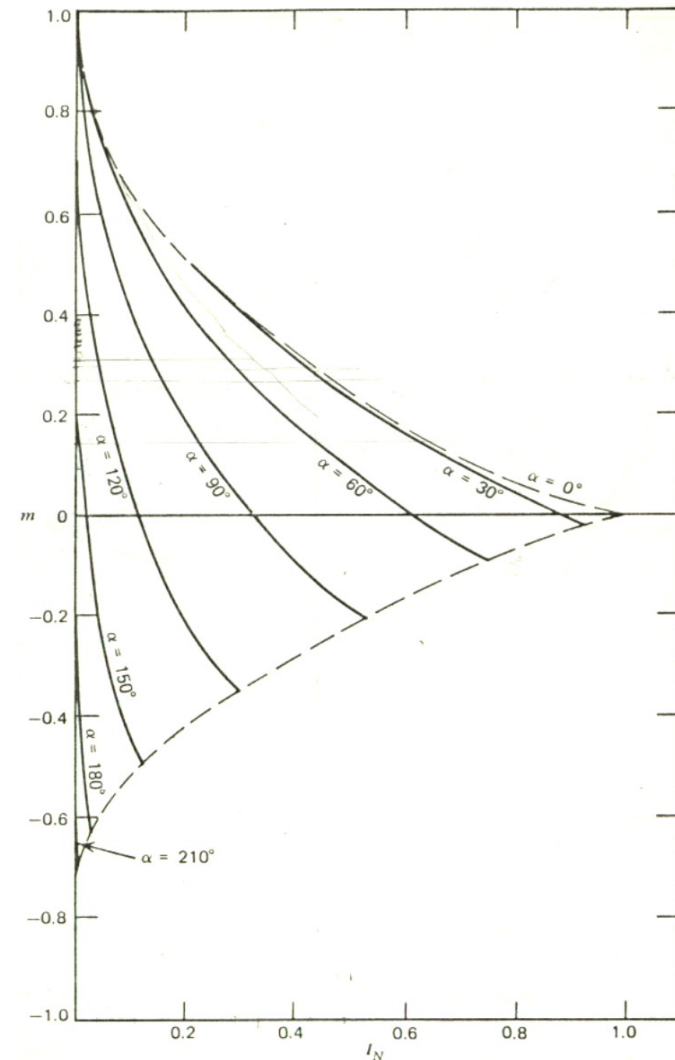


$$i_N = \text{sen}(\omega.t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{(\alpha - \omega.t)/\tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \text{sen}(\alpha - \phi) \right]$$

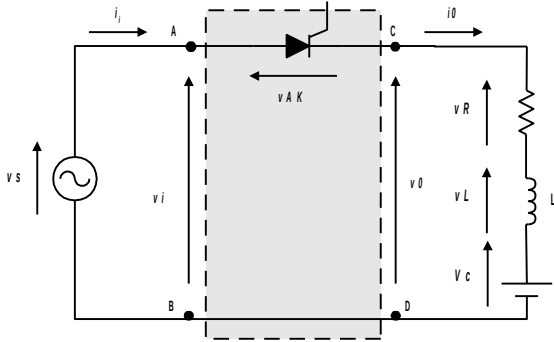
$$i_N = \frac{i(\omega.t)}{I_{base}} \quad ; \quad I_{base} = \frac{\sqrt{2}.V}{Z}$$

$$I_{RN} = \frac{1}{2\pi} \int_{\alpha}^{\beta=\gamma+\alpha} i_N.d\omega.t \quad ; \quad \phi = 90^\circ$$



RETIFICADOR MONOFÁSICO DE MEIA-ONDA CONTROLADO

Corrente RMS Normalizada – Carga RL+fem



$$i_N = \sin(\omega t - \phi) - \left[\frac{m}{\cos \phi} - B.e^{(\alpha - \omega t) / \tan \phi} \right]$$

$$B = \left[\frac{m}{\cos \phi} - \sin(\alpha - \phi) \right]$$

$$i_N = \frac{i(\omega t)}{I_{base}} \quad ; \quad I_{base} = \frac{\sqrt{2}V}{Z}$$

$$I_{RN} = \sqrt{\frac{1}{2\pi} \int_{\alpha}^{\beta = \gamma + \alpha} i_N^2 d\omega t} \quad ; \quad \phi = 90^\circ$$

