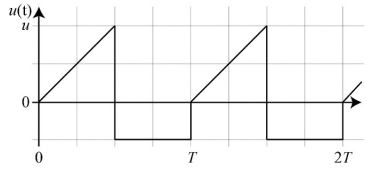
Bsp 1

Bestimmen Sie für die gezeigte Spannung

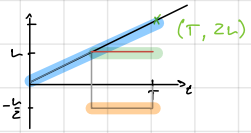
- Mittelwert ū
- Gleichrichtwert |ū|
- Effektivwert U
- Spitze-Spitze-Wert u_{ss}



MITTELWERT $\bar{u} = \frac{1}{T}\int_{t_0}^{t_0+T} u(t)\,dt = \frac{1}{T}\int_0^T u(t)\,dt = \frac{1}{T}\left[\int_0^{T/2} \frac{2u}{T}\,t\,dt + \int_{T/2}^{T} \frac{u}{2}\,dt\right]$

$= \frac{1}{T}\left[\frac{u\,t^2}{T}\Big|_0^{T/2} - \frac{uT}{4}\right]$

$= \frac{1}{T}\left[\frac{uT}{4} - \frac{uT}{4}\right] = 0$



GLEICHRICHTWERT $|\bar{u}| = \frac{1}{T}\left[\int_0^{T/2} \frac{2u}{T}\,t\,dt + \int_{T/2}^{T} \frac{u}{2}\,dt\right] = \ldots = \frac{u}{2}$

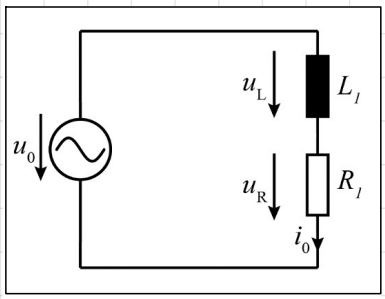
EFFEKTIVWERT $u\ (= u_{eff}) = \sqrt{\frac{1}{T}\int_0^T u^2(t)\,dt} = \sqrt{\frac{1}{T}\left(\int_0^{T/2} \frac{4u^2t^2}{T^2}\,dt + \int_{T/2}^{T} \frac{u^2}{4}\,dt\right)}$

$= \sqrt{\frac{1}{T}\left(\frac{4u^2t^3}{3T^2}\Big|_0^{T/2} + \frac{u^2t}{4}\Big|_{T/2}^{T}\right)} = \sqrt{\frac{1}{T}\left(\frac{4u^2T}{24} + \frac{u^2T}{4} - \frac{u^2T}{8}\right)}$

$= \sqrt{\frac{1}{T}\left(\frac{u^2T}{6} + \frac{u^2T}{8}\right)} = u\sqrt{\frac{7}{24}}$

SPITZE - SPITZE - WERT $u_{ss} = \frac{3}{2}u$ (ABLESEN)

Bsp 2



Gegeben:

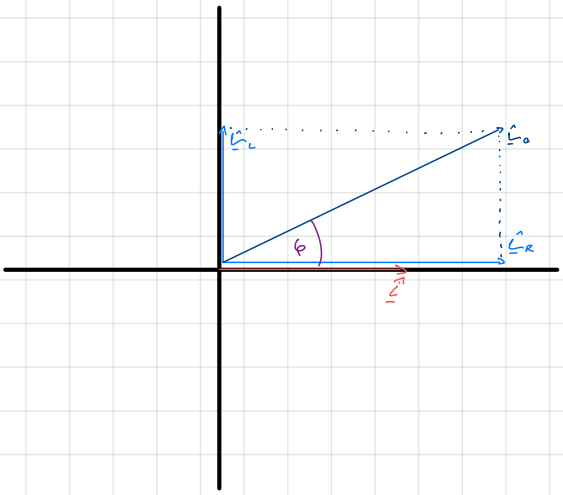
$i(t) = \hat{\imath}\cos(\omega t)$, $\hat{\imath}$ =1A, $\omega = 1000Hz$, $R = 2\Omega$, $L = 1mH$

BASIC, ABER WICHTIG: $\omega = 2\pi f = \frac{2\pi}{T}$

- $L_R(t) = R \cdot i(t) = R \cdot \hat{\imath}\cos(\omega t) = 2 \cdot \cos(1000t) = 2 \cdot \sin(1000t + \frac{\pi}{2})$

  $L_L(t) = L \cdot \frac{d}{dt} i(t) = -L \cdot \omega \cdot \hat{\imath} \cdot \sin(\omega t) = -1 \cdot \sin(1000t)$

  ($L \cdot \omega \cdot \hat{\imath} = 1$)

- 

- $L_0(0) = 2V$

  $i_0(0) = \hat{\imath}\cos(0) = \hat{\imath} = 1A$

  $L(t)$ ≙ REALTEILE DER ZEIGER BEI t

- ALS $\omega = 1000$ Hz FOLGT DIREKT: $T = \frac{2\pi}{\omega} = 6.28 \cdot 10^{-3}$ s $\Longrightarrow \frac{T}{8} = 7.85 \cdot 10^{-4}$ s

  SOMIT IST: $L_0(T/8) = |\hat{L}_0| \cdot \cos(\omega\frac{T}{8} + \varphi)$

  φ = PHASENVERSCHIEBUNG

  $= \sqrt{2^2 + 1^2} \cdot \cos(\omega\frac{T}{8} + 26.6°)$

  $= \Re\{TR\} = 0.71A$

  $i(\frac{T}{8}) = \hat{\imath}\cos(\omega\frac{T}{8}) = \Re\{TR\} = 0.71A$