

task_abh4vhlgczdbni37_with_calculation

Student Group

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signal analysis, RMS, exam ee2 SS2021

Exercise E1 Signal Analysis
(written test, approx. 6 % of a 120-minute written test, SS2021)

A) Determine the effective value of the signal $i(t)$ and the phase angle φ (in degrees) if the quantities are available in the consumer arrow system. (hard)

- $u(t) = 50 \sqrt{2} \cos(6000 t + 4)$ V

- $i(t) = 30 \sqrt{2} \sin(6000 t + 5)$ A

Result

a) Determine the amplitude values \hat{u} , \hat{i} and the RMS values U , I

- $f = 955$ Hz

- $\hat{u} = 50 \sqrt{2}$ V

The frequency can be derived by the term in the sine function: $\omega = 6000$ rad/s

- $\hat{i} = 30 \sqrt{2}$ A

- $f = \frac{\omega}{2\pi} = \frac{6000}{2\pi} \approx 954.93$ Hz

RMS values:

For the phase φ , we have to subtract φ_i from φ_u .

But to get these values, both the $u(t)$ and $i(t)$ need to have the same sinusoidal function! Therefore:

- $U = 35.4$ V
- The amplitude values \hat{u} , \hat{i} are given directly by the coefficient of the cosine and sine functions

- For the RMS values of sinusoidal functions the amplitudes have to be multiplied with $\frac{1}{\sqrt{2}}$
- $\varphi_u = 4 + \frac{\pi}{2}$

By this we get for φ

$$\varphi = \varphi_u - \varphi_i = 4 + \frac{\pi}{2} - 5 = 2.14159 \dots$$

Converted in degree:

$$\varphi = 2.14159 \dots \cdot \frac{360^\circ}{2\pi} = 32.7042 \dots^\circ$$

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Last update: 2024/07/04 02:36

