MLSZ_WO5: BSP 1

1) ALLGEMEIN: $\underline{S}_i = \underline{U}_i \cdot \underline{I}_i^*$

$$P_i = Re\{\underline{S}_i\} = Re\{\underline{U}_i \underline{I}_i^*\} = \frac{1}{2} Re\{\hat{\underline{u}}_i \hat{\underline{i}}_i^*\}$$

WOBEI $$\hat{\underline{i}}_i = \frac{\hat{\underline{u}}_i}{\underline{Z}_i} = \frac{|\hat{\underline{u}}| \cdot e^{-j(\arctan[\frac{\omega L_i}{R_i}] + \varphi_i)}}{\sqrt{R_i^2 + (\omega L)^2}}$$

DIESER SCHRITT HAT'S IN SICH :)

$$\frac{\hat{\underline{u}}_i}{\underline{Z}_i} = \left(\frac{1}{R + j\omega L}\right) \hat{u} e^{j\varphi_i} = \frac{(R_i - j\omega L_i)}{R_i^2 + (\omega L_i)^2} \hat{\underline{u}}_i = \left[\frac{R_i}{R_i^2 + (\omega L_i)^2} - j \frac{\omega L_i}{R_i^2 + (\omega L_i)^2}\right] \hat{\underline{u}}_i$$

$$= \left[\sqrt{\frac{R_i^2}{[R_i^2 + (\omega L_i)^2]^2} + \frac{(\omega L_i)^2}{[R_i^2 + (\omega L_i)^2]^2}} \; e^{j(\arctan(-\frac{\omega L_i}{R_i}))}\right] \hat{\underline{u}}_i$$

$$= \left[\frac{\sqrt{R_i^2 + (\omega L_i)^2}}{R_i^2 + (\omega L_i)^2} \; e^{-j(\arctan(\frac{\omega L_i}{R_i}))}\right] \hat{\underline{u}}_i$$

$$= \left[\frac{1}{\sqrt{R_i^2 + (\omega L_i)^2}} \; e^{-j(\arctan(\frac{\omega L_i}{R_i}))}\right] \hat{u} e^{j\varphi_i}$$

$\rightsquigarrow$ HIER: $$P_{tot} = \sum_i P_i = P_1 + P_2 + P_3 = \frac{1}{2} Re\{\hat{\underline{u}}_1 \hat{\underline{i}}_1^* + \hat{\underline{u}}_2 \hat{\underline{i}}_2^* + \hat{\underline{u}}_3 \hat{\underline{i}}_3^*\}$$

$$= \frac{|\hat{\underline{u}}|^2}{2} Re\left\{ \frac{e^{+j(\arctan[\frac{\omega L_1}{R_1}])} e^{-j0°}}{\sqrt{R_1^2 + (\omega L_1)^2}} e^{j0°} + \frac{e^{+j(\arctan[\frac{\omega L_2}{R_2}])} e^{-j120°}}{\sqrt{R_2^2 + (\omega L_2)^2}} \cdot e^{j120°} + \frac{e^{+j(\arctan[\frac{\omega L_3}{R_3}])} e^{-j240°}}{\sqrt{R_3^2 + (\omega L_3)^2}} \cdot e^{j240°} \right\}$$

$$= \frac{|\hat{\underline{u}}|^2}{2} Re\left\{ \frac{e^{+j(\arctan[\frac{\omega L_1}{R_1}])}}{\sqrt{R_1^2 + (\omega L_1)^2}} + \frac{e^{+j(\arctan[\frac{\omega L_2}{R_2}])}}{\sqrt{R_2^2 + (\omega L_2)^2}} + \frac{e^{+j(\arctan[\frac{\omega L_3}{R_3}])}}{\sqrt{R_3^2 + (\omega L_3)^2}} \right\}$$

MUS2_W05: BSP_TEIL 2 :

1.2)

HIER IST DIE LEISTUNG AM VERBRAUCHER :

$$P = \frac{|\hat{\underline{u}}|^2}{2} \, \mathrm{Re}\left\{ \frac{e^{+j(\arctan[\frac{\omega L}{R}])}}{\sqrt{R^2+(\omega L)^2}} + \frac{e^{+j(\arctan[\frac{\omega L}{R}])}}{\sqrt{R^2+(\omega L)^2}} + \frac{e^{+j(\arctan[\frac{\omega L}{R}])}}{\sqrt{R^2+(\omega L)^2}} \right\}$$

$$= 3 \cdot \frac{|\hat{\underline{u}}|}{2} \, \mathrm{Re}\left\{ \frac{e^{+j(\arctan[\frac{\omega L}{R}])}}{\sqrt{R^2+(\omega L)^2}} \right\}$$

$$= 3 \cdot \frac{|\hat{\underline{u}}|}{2} \cdot \frac{1}{\sqrt{R^2+(\omega L)^2}} \cdot \mathrm{Re}\left\{ e^{+j(\arctan[\frac{\omega L}{R}])} \right\}$$

$$= \underline{\underline{3 \cdot \frac{|\hat{\underline{u}}|}{2} \cdot \frac{1}{\sqrt{R^2+(\omega L)^2}} \cdot \cos\left[\arctan\left(\frac{\omega L}{R}\right)\right]}}$$

1.3) KCL (KIRCHHOFF) :

$$\hat{\underline{i}}_M = \hat{\underline{i}}_1 + \hat{\underline{i}}_2 + \hat{\underline{i}}_3 = \sum_i \frac{|\hat{\underline{u}}| \cdot e^{-j(\arctan[\frac{\omega L}{R_i}])}}{\sqrt{R_i^2+(\omega L)^2}}$$

$$= \frac{|\hat{\underline{u}}|}{\sqrt{R^2+(\omega L)^2}} \, e^{-j(\arctan(\frac{\omega L}{R}))} \cdot \left[1 + e^{-j120^\circ} + e^{-240^\circ}\right] = \underline{\underline{0}}$$

UND WAS BRINGT UNS DAS JETZT ? :)