

rechnung_betragundphase_umkehrintegrator

Student Group

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\$\;\$	\$U_A = -\{ 1 \over {R \cdot C} \} \cdot \int_{t_0}^{t_1} \color{blue}{U_E(t)} \, dt + U_{A0}\$
\$\;\$	insert sine function: $\color{blue}{U_E(t)} = \hat{U}_E \cdot \sin(\omega \cdot t)$
\$\;\$	$\color{blue}{U_A} = -\{ 1 \over {R \cdot C} \} \cdot \int_{t_0}^{t_1} \hat{U}_E \cdot \sin(\omega \cdot t) \, dt + U_{A0}$
\$\;\$	insert root function with limits $\color{blue}{\int_{x_0}^{x_1} \sin(a \cdot x) \, dx} = [-1 \over a] \cdot \cos(a \cdot x)$
\$\;\$	$\color{blue}{U_A} = -\{ 1 \over {R \cdot C} \} \cdot [-1 \over \omega] \cdot \cos(\omega \cdot t) \Big _{t_0}^{t_1} + U_{A0}$
\$\;\$	put constant before integral
\$\;\$	$\color{blue}{U_A} = \{ 1 \over {R \cdot C} \} \cdot \{ \hat{U}_E \over \omega \} \cdot [\cos(\omega \cdot t_0) - \cos(\omega \cdot t_1)] + U_{A0}$
\$\;\$	insert limits: $t_0=0, t_1=t$
\$\;\$	$\color{blue}{U_A} = \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} \cdot (\cos(\omega \cdot t) - \cos(0)) + U_{A0}$
\$\;\$	$\color{blue}{\cos(0)} = 1$
\$\;\$	$\color{blue}{U_A} = \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} \cdot (\cos(\omega \cdot t) - 1) + U_{A0}$
\$\;\$	multiply
\$\;\$	$\color{blue}{U_A} = \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} \cdot \cos(\omega \cdot t) - \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} + U_{A0}$
\$\;\$	consider the non-cosine terms
\$\;\$	$\color{blue}{U_A} = \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} \cdot \cos(\omega \cdot t) - \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} + U_{A0}$
\$\;\$	This part is independent in time. Since we assume purely sinusoidal quantities, the initial voltage of the capacitor must be: $U_{C0} = U_{A0} = \{ \hat{U}_E \over {\omega \cdot R \cdot C} \}$
\$\;\$	$\color{blue}{U_A} = \{ \hat{U}_E \over {\omega \cdot R \cdot C} \} \cdot \cos(\omega \cdot t)$

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