

rechnung_umkehrintegrator

Student Group

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$U_A = f(U_E)$
with III.
$U_A = \textcolor{blue}{-U_D} - U_C$
with II. and I.: $\textcolor{blue}{U_D} = \frac{1}{A_D} \cdot U_A \overset{A_D \rightarrow \infty}{\longrightarrow} 0$
$U_A = \textcolor{blue}{0} - U_C$
with V.: $\textcolor{blue}{U_C} = \frac{1}{C} \cdot \left(\int_{t_0}^{t_1} I_C \, dt + Q_0(t_0) \right)$
$U_A = -\frac{1}{C} \cdot \left(\int_{t_0}^{t_1} \textcolor{blue}{I_C} \, dt + Q_0(t_0) \right)$
with IV.: $\textcolor{blue}{I_C} = I_R$
$U_A = \textcolor{blue}{-\frac{1}{C} \cdot \left(\int_{t_0}^{t_1} I_R \, dt + Q_0(t_0) \right)}$
Factor out
$U_A = -\frac{1}{C} \cdot \int_{t_0}^{t_1} I_R \, dt - \textcolor{blue}{\frac{Q_0(t_0)}{C}}$
consider the integration constant: $\textcolor{blue}{\frac{Q_0(t_0)}{C}} = U_C(t_0) = -U_{A0}$
$U_A = -\frac{1}{C} \cdot \int_{t_0}^{t_1} \textcolor{blue}{I_R} \, dt + U_{A0}$
with VI. and II.: $\textcolor{blue}{I_R} = \frac{U_R}{R} = \frac{U_E}{R}$
$U_A = -\frac{1}{C} \cdot \int_{t_0}^{t_1} \textcolor{blue}{\frac{1}{R} \cdot U_E} \, dt + U_{A0}$
move constant ahead
$U_A = -\frac{1}{R \cdot C} \cdot \int_{t_0}^{t_1} U_E \, dt + U_{A0}$
insert time constant $\tau = R \cdot C$
$U_A = -\frac{1}{\tau} \cdot \int_{t_0}^{t_1} U_E \, dt + U_{A0}$

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