

# rechnung\_betragundphase\_umkehrintegrator

## Student Group

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$U_{\text{O}} = -\frac{1}{R \cdot C} \int_{t_0}^{t_1} U_{\text{I}}(t) \, dt + U_{\text{O0}}$
<p>insert sine function:</p> $U_{\text{I}}(t) = \hat{U}_{\text{I}} \cdot \sin(\omega \cdot t)$
$U_{\text{O}} = -\frac{1}{R \cdot C} \int_{t_0}^{t_1} \hat{U}_{\text{I}} \cdot \sin(\omega \cdot t) \, dt + U_{\text{O0}}$
<p>insert root function with limits</p> $\int_{x_0}^{x_1} \sin(a \cdot x) \, dx = \left[ -\frac{1}{a} \cdot \cos(a \cdot x) \right]_{x_0}^{x_1}$
$U_{\text{O}} = -\frac{1}{R \cdot C} \int_{t_0}^{t_1} \frac{\hat{U}_{\text{I}}}{\omega} \cdot \cos(\omega \cdot t) \, dt + U_{\text{O0}}$
<p>put constant before integral</p>
$U_{\text{O}} = \frac{1}{R \cdot C} \cdot \frac{\hat{U}_{\text{I}}}{\omega} \int_{t_0}^{t_1} \cos(\omega \cdot t) \, dt + U_{\text{O0}}$
<p>insert limits: <math>t_0=0</math>, <math>t_1=t</math></p>
$U_{\text{O}} = \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} \int_0^t \cos(\omega \cdot t) \, dt - \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} \cdot \cos(0) + U_{\text{O0}}$
$\cos(0) = 1$
$U_{\text{O}} = \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} \int_0^t \cos(\omega \cdot t) \, dt - \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} + U_{\text{O0}}$
<p>multiply</p>
$U_{\text{O}} = \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} \int_0^t \cos(\omega \cdot t) \, dt - \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} + U_{\text{O0}}$
<p>consider the non-cosine terms:                  The blue part is independent in time.                  We assume purely sinusoidal quantities!</p>
$U_{\text{O}} = \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} \int_0^t \cos(\omega \cdot t) \, dt - \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} + U_{\text{O0}}$
<p><math>\rightarrow</math> initial voltage of the capacitor:  <math>U_{\text{C0}} = U_{\text{O0}} = \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C}</math></p>
$U_{\text{O}} = \frac{\hat{U}_{\text{I}}}{\omega \cdot R \cdot C} \int_0^t \cos(\omega \cdot t) \, dt$

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