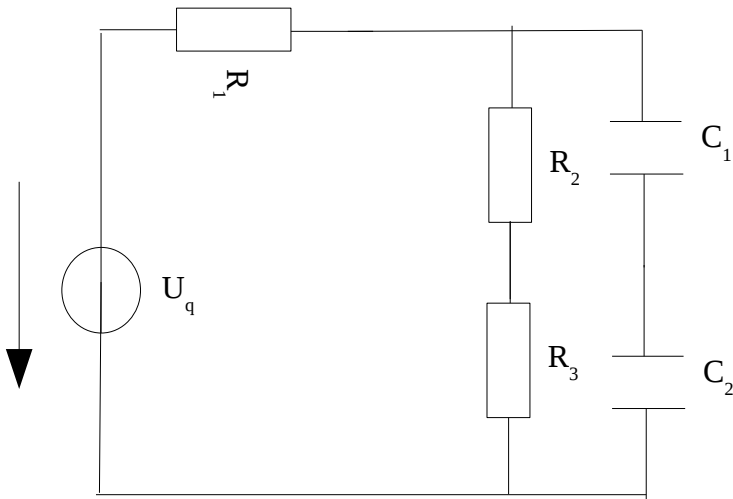


Elektrotechnik

RC-Schaltung mit Quelle

Berechne bei folgender Schaltung die Spannung an C_2 :



R_1 : 1 Ω ;

R_2 : 100 Ω ;

R_3 : 100 Ω ;

C_1 : 1.5 μ ;

C_2 : 500 nF ;

ω : 5000 s^{-1} ;

Lösung:

Über den Spannungsteiler:

$$Z_1 = R_1 + \frac{R_2 \cdot \frac{1}{j\omega C_1}}{R_2 + \frac{1}{j\omega C_1}} = R_1 + \frac{R_2}{j\omega C_1 R_2 + 1}$$

$$Z_2 = \frac{R_3 \cdot \frac{1}{j\omega C_2}}{R_3 + \frac{1}{j\omega C_2}} = \frac{R_3}{j\omega C_2 R_3 + 1}$$

$$u_{C_2}(t) = u_q(t) \cdot \frac{Z_2}{Z_1 + Z_2} = u_q(t) \cdot \frac{\frac{R_3}{j\omega C_2 R_3 + 1}}{R_1 + \frac{R_2}{j\omega C_1 R_2 + 1} + \frac{R_3}{j\omega C_2 R_3 + 1}}$$

Für die Zahlenwerte siehe unter Beispiele mit wxmaxima berechnet:

```
(%i519) R1: 1;
R2: 100 ;
R3: 100 ;
C1: 1.5*10^(-6);
C2: 0.5*10^(-6);
w: 10000;
Zaehler: ((R3/(1+%i*w*C2*R3)));
Nenner: (R1+(R2/(1+%i*w*C1*R2))+(R3/(1+%i*w*C2*R3))
);
Wert: Zaehler / Nenner;
factor(Wert);
rectform(Wert);
ratsimp(Wert);
gfactor(Wert);
expand(%);
exponentialize(%);
polarform(%);
expand(Wert);
exponentialize(Wert);
polarform(Wert);
```

(%o519) 1

(%o520) 100

(%o521) 100

(%o522) $1.5 \cdot 10^{-6}$

(%o523) $4.9999999999999998 \cdot 10^{-7}$

(%o524) 10000

(%o525) $\frac{100}{0.5 \%i + 1}$

(%o526) $\frac{100}{1.5 \%i + 1} + \frac{100}{0.5 \%i + 1} + 1$

(%o527) $\frac{100}{(0.5 \%i + 1) \left(\frac{100}{1.5 \%i + 1} + \frac{100}{0.5 \%i + 1} + 1 \right)}$

rat: replaced 0.5 by 1/2 = 0.5

rat: replaced 0.5 by 1/2 = 0.5

rat: replaced 1.5 by 3/2 = 1.5

(%o528) $\frac{200(3 \%i + 2)}{808 \%i + 801}$

(%o529) $0.12159463562167 \%i + 0.62203304067704$

rat: replaced 0.5 by 1/2 = 0.5

rat: replaced 0.5 by 1/2 = 0.5

rat: replaced 1.5 by 3/2 = 1.5

(%o530) $\frac{1600 \%i + 200}{2417 \%i + 794}$

rat: replaced 0.5 by 1/2 = 0.5

rat: replaced 0.5 by 1/2 = 0.5

rat: replaced 1.5 by 3/2 = 1.5

(%o531) $\frac{200(3 \%i + 2)}{808 \%i + 801}$

(%o532) $\frac{600 \%i}{808 \%i + 801} + \frac{400}{808 \%i + 801}$

(%o533) $\frac{600 \%i}{808 \%i + 801} + \frac{400}{808 \%i + 801}$

(%o534) $\frac{40 \sqrt{65} \%e^{\%i \operatorname{atan}\left(\frac{787}{4026}\right)}}{\sqrt{258893}}$

(%o535) $\frac{100}{\frac{50.0 \%i}{1.5 \%i + 1} + \frac{100}{1.5 \%i + 1} + \frac{50.0 \%i}{0.5 \%i + 1} + 0.5 \%i + \frac{100}{0.5 \%i + 1} + 1}$

(%o536) $\frac{100}{(0.5 \%i + 1) \left(\frac{100}{1.5 \%i + 1} + \frac{100}{0.5 \%i + 1} + 1 \right)}$

(%o537) $0.63380624729162 \%e^{0.19304505901876 \%i}$

```

R1: 1;
R2: 100 ;
R3: 100 ;
C1: 1.5*10^(-6);
C2: 0.5*10^(-6);
w: 5000;
Zaehler: ((R3/(1+%i*w*C2*R3)));
Nenner: (R1+(R2/(1+%i*w*C1*R2)))+(R3/(1+%i*w*C2*R3))
);
(%i1) Wert: Zaehler / Nenner;
factor(Wert);
rectform(Wert);
ratsimp(Wert);
gfactor(Wert);
expand(%);
exponentialize(%);
polarform(%);
expand(Wert);
exponentialize(Wert);
polarform(Wert);

```

- (%o1) 1
- (%o2) 100
- (%o3) 100
- (%o4) $1.5 \cdot 10^{-6}$
- (%o5) $4.9999999999999998 \cdot 10^{-7}$
- (%o6) 5000

(%o7) $\frac{100}{0.25 \%i + 1}$

(%o8) $\frac{100}{0.75 \%i + 1} + \frac{100}{0.25 \%i + 1} + 1$

(%o9) $\frac{100}{\left(\frac{100}{0.75 \%i + 1} + \frac{100}{0.25 \%i + 1} + 1\right)(0.25 \%i + 1)}$

rat: replaced 0.25 by 1/4 = 0.25

rat: replaced 0.75 by 3/4 = 0.75

rat: replaced 0.25 by 1/4 = 0.25

(%o10) $\frac{400(3 \%i + 4)}{1616 \%i + 3213}$

(%o11) $0.098184552168274 \%i + 0.54735955067038$

rat: replaced 0.25 by 1/4 = 0.25

rat: replaced 0.75 by 3/4 = 0.75

rat: replaced 0.25 by 1/4 = 0.25

(%o12) $\frac{6400 \%i + 5200}{9677 \%i + 11236}$

rat: replaced 0.25 by 1/4 = 0.25

rat: replaced 0.75 by 3/4 = 0.75

rat: replaced 0.25 by 1/4 = 0.25

(%o13) $\frac{400(3 \%i + 4)}{1616 \%i + 3213}$

(%o14) $\frac{1200 \%i}{1616 \%i + 3213} + \frac{1600}{1616 \%i + 3213}$

(%o15) $\frac{1200 \%i}{1616 \%i + 3213} + \frac{1600}{1616 \%i + 3213}$

(%o16) $\frac{400 \%e^{\%i \operatorname{atan}\left(\frac{127}{708}\right)}}{\sqrt{517393}}$

(%o17) $\frac{100}{\frac{25.0 \%i}{0.75 \%i + 1} + \frac{25.0 \%i}{0.25 \%i + 1} + 0.25 \%i + \frac{100}{0.75 \%i + 1} + \frac{100}{0.25 \%i + 1} + 1}$

(%o18) $\frac{100}{\left(\frac{100}{0.75 \%i + 1} + \frac{100}{0.25 \%i + 1} + 1\right)(0.25 \%i + 1)}$

(%o19) $0.55609593056825 \%e^{0.1774909078193 \%i}$

