

if I define all the variables on the right, the only unknowns remained should be Ctop and Rbot. I want to get all the expression with variables Ctop and Rbot and substitute all other symbols with real numbers.

$$C_{cl} := 20 \cdot 10^{-12} \quad C_c := 10.5 \cdot 10^{-12}$$

$$f := 500000 \quad \omega := 2 \cdot \pi \cdot f \quad R_{vesr} := 442500$$

$$V_{out} := 3.3$$

$$V_{ref} := 0.75$$

$$V_{in} := 12$$

$$Z_{cl} := \frac{1}{i \cdot \omega \cdot C_{cl}} \quad Z_{cc} := \frac{1}{i \cdot \omega \cdot C_c}$$

$$R_{top}(R_{bot}) := R_{bot} \cdot \left( \frac{V_{out} - V_{ref}}{V_{ref}} \right) \quad R_{eq}(R_{bot}) := R_{bot} \cdot \frac{R_{top}(R_{bot})}{R_{bot} + R_{top}(R_{bot})}$$

$$Z_{top}(C_{top}) := \frac{1}{i \cdot \omega \cdot C_{top}} \quad Z_{eq}(R_{bot}, C_{top}) := Z_{cc} + R_{eq}(R_{bot}) \cdot \frac{Z_{top}(C_{top})}{R_{eq}(R_{bot}) + Z_{top}(C_{top})}$$

$$Z_{tot}(R_{bot}, C_{top}) := R_{vesr} + \frac{Z_{eq}(R_{bot}, C_{top}) \cdot Z_{cl}}{Z_{eq}(R_{bot}, C_{top}) + Z_{cl}}$$

$$T_{on} := \frac{V_{out}}{V_{in} \cdot f}$$

$$V_{cl}(R, C) := (V_{in} - V_{out}) \cdot \left( 1 - e^{\frac{-T_{on}}{R \cdot C}} \right) \quad \text{Made this a function of R and C because these aren't yet specified.}$$

$$V_{fb1}(R_{bot}, C_{top}) := V_{cl}(R_{bot}, C_{top}) \cdot R_{eq}(R_{bot}) \cdot \frac{Z_{top}(C_{top})}{Z_{cc} \cdot (R_{eq}(R_{bot}) + Z_{top}(C_{top})) + R_{eq}(R_{bot}) \cdot Z_{top}(C_{top})}$$

$$\begin{array}{l|l} \text{R} := \text{Re}(\text{Z}_{\text{tot}}(\text{Rbot}, \text{Ctop})) & \begin{array}{l} \text{assume, ALL} > 0 \\ \text{simplify} \end{array} \end{array} \rightarrow 442500.0 - \frac{1.0 \cdot (7.2077768073098629401e19 \cdot \text{Rbot}^2 - 5.0115689594749792489e56 \cdot \text{Ctop}^2 \cdot \text{Rbot}^2 +$$

$$C := \frac{1}{\omega \cdot |\text{Im}(\text{Ztot}(\text{Rbot}, \text{Ctop}))|} \left| \begin{array}{l} \text{assume, ALL = real} \\ \text{simplify} \end{array} \right. \rightarrow \frac{3.1904638901853977782\text{e}88 \cdot \text{Ctop}^2 \cdot \text{Rbot}^2 + 4.3}{1.046053734487015665\text{e}99 \cdot \text{Ctop}^2 \cdot \text{Rbot}^2 + 1.8}$$

[illegible]

$$\text{Im}(\text{Vfb1}(\text{Rbot}, \text{Ctop})) \left| \begin{array}{l} \text{assume, All = real} \\ \text{simplify} \end{array} \right. \rightarrow -\text{Im} \left[ \frac{(-0.0000021399105530264836509186i) \cdot \text{Rbot} + (0.02342540287155278e-7i) \cdot \text{Ctop}}{(2.45966730232929155278e-7i) \cdot \text{Rbot} + (23425.40287155278e-7i) \cdot \text{Ctop}} \right]$$

variables need to be defined:  $C_{cl}$ ,  $V_{in}$ ,  $V_{out}$ ,  $V_{ref}$ ,  $C_c$ ,  $\omega$ ,  $R_{vesr}$ ,  $f$ ,  $T_{on}$

**Remember Mathcad works left-to-right, top-to-bottom**

$$\frac{7.788012576198740286e42 \cdot R_{bot} + 1.3680327868852459016e31 \cdot C_{top} \cdot R_{bot}^2 + 1.1438185860691173225e29)}{6.901176927801610769e45 \cdot C_{top} \cdot R_{bot}^2 + 2.375815007931702068e34 \cdot R_{bot}^2 + 8.5039653929942814098e43}$$

$$\frac{3934256848454657929e77 \cdot C_{top} \cdot R_{bot}^2 + 1.5124908095369636336e66 \cdot R_{bot}^2 + 5.413792512709808849e75}{18590140038491988e88 \cdot C_{top} \cdot R_{bot}^2 + 7.5624540476848181681e76 \cdot R_{bot}^2 + 1.7750139385933799505e86}$$

$$\left[ \frac{000021399105530264836509186i) \cdot R_{bot} \cdot e^{\frac{1}{C_{top}} - 5.5e-7}}{9326586217i) \cdot C_{top} \cdot R_{bot} + 0.00964963653736550204227} \right]$$

$$\left[ \frac{000021399105530264836509186i) \cdot R_{bot} \cdot e^{\frac{1}{C_{top}} - 5.5e-7}}{9326586217i) \cdot C_{top} \cdot R_{bot} + 0.00964963653736550204227} \right]$$