Beregning af 0-punkter

$R_{out} := 8.4\ \Omega \qquad D := 0.447 \qquad N_{ps} := 1 \qquad L_p := 57.7\ \mu H \qquad f_s := 100\ kHz$

$R_{ESR} := \left(\left(15\ \Omega \cdot 10^{-3}\right)^{-1} \cdot 4 \right)^{-1} = 3.75\ \Omega \cdot 10^{-3} \qquad C_{out} := 56\ \mu F \cdot 4 = 224\ \mu F$

$$f_{RHPZ} := \frac{R_{out} \cdot (1-D)^2 \cdot N_{ps}^{\ 2}}{2\ \pi \cdot L_p \cdot D} = 15.851\ kHz \qquad \omega_{RHPZ} := 2\ \pi \cdot f_{RHPZ}$$

$$f_{ESRz} := \frac{1}{2\ \pi \cdot R_{ESR} \cdot C_{out}} = 189.47\ kHz \qquad \omega_{ESRz} := 2\ \pi \cdot f_{ESRz}$$

$$f_{BW} := \frac{f_{RHPZ}}{3} = 5.284\ kHz$$

$V_{inmin} := 26\ V \qquad V_{out} := 21\ V$

$$\tau_L := \frac{2 \cdot L_p \cdot f_s}{R_{out} \cdot N_{ps}} = 1.374$$

$$M := \frac{V_{out} \cdot N_{ps}}{V_{inmin}} = 0.808$$

Open-loop gain:

$A_{CS} := 1.65 \qquad R_{CS} := 0.167\ \Omega$

$$G_o := \frac{R_{out} \cdot N_{ps}}{R_{CS} \cdot A_{CS}} \cdot \frac{1}{\frac{(1-D)^2}{\tau_L} + (2 \cdot M) + 1} = 10.742 \qquad 20 \cdot \log\left(G_o\right) = 20.621$$

Beregning af poler

$$f_{p1} := \frac{\frac{(1-D)^3}{\tau_L} + 1 + D}{2\ \pi \cdot R_{out} \cdot C_{out}} = 132.807\ Hz \qquad \omega_{p1} := 2\ \pi \cdot f_{p1}$$

$$f_{p2} := \frac{f_s}{2} = 50\ kHz \qquad \omega_{p2} := 2\ \pi \cdot f_{p2}$$

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$$s := 0$$

$$H_0 := G_o \cdot \frac{\left(1 + \frac{s}{\omega_{ESRz}}\right) \cdot \left(1 - \frac{s}{\omega_{RHPZ}}\right)}{1 + \frac{s}{\omega_{p1}}} \cdot \frac{1}{1 + \frac{s}{\omega_{p2}} + \frac{s^2}{\omega_{p2}^2}} \rightarrow 10.741599241902968$$

Beregning af kompenseringsnetværk

$R_{FB1} := 18.7\ k\Omega$ $R_{FB2} := 2.55\ k\Omega$ $A_{oldb} := -5.4$ $A_{ol} := 10^{\frac{A_{oldb}}{20}} = 0.537$

$R_{par} := \left(R_{FB1}^{-1} + R_{FB2}^{-1}\right)^{-1} = 2.244\ k\Omega$

$$R_{comp} := A_{ol} = \frac{R_{comp}}{R_{par}} \cdot \frac{R_{FB2}}{R_{FB1} + R_{FB2}} \xrightarrow{solve, R_{comp}} 10.042494592123724929 \cdot k\Omega$$

$f_{zero} := 300\ Hz$ $R_{comp} := 10\ k\Omega$

$$C_{comp} := \frac{1}{2 \cdot \pi \cdot R_{comp} \cdot C_{comp}} = f_{zero} \xrightarrow{solve, C_{comp}} \frac{1}{6000 \cdot \pi \cdot Hz \cdot k\Omega}$$

$C_{comp} = 53.052\ nF$ $C_{comp} := 50\ nF$

$f_{zero} := \frac{1}{2 \cdot \pi \cdot R_{comp} \cdot C_{comp}} = 318.31\ Hz$

Optimering af reguleringsloop. ønsket gain aflæses på bode plot i db.

$A_{oldb} := 8.5$ $A_{ol} := 10^{\frac{A_{oldb}}{20}} = 2.661$

$$R_{comp} := \frac{R_{comp1}}{R_{par}} \cdot \frac{R_{FB2}}{R_{FB1} + R_{FB2}} = A_{ol} \xrightarrow{solve, R_{comp1}} 49.75555861823774139 \cdot k\Omega$$

$f_{zero} := 132.8\ Hz$

$$C_{comp} := \frac{1}{2 \cdot \pi \cdot R_{comp} \cdot C_{comp1}} = f_{zero} \xrightarrow{solve, C_{comp1}} \frac{0.00002408687451329367873}{Hz \cdot k\Omega}$$

$C_{comp} = 24.087\ nF$

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