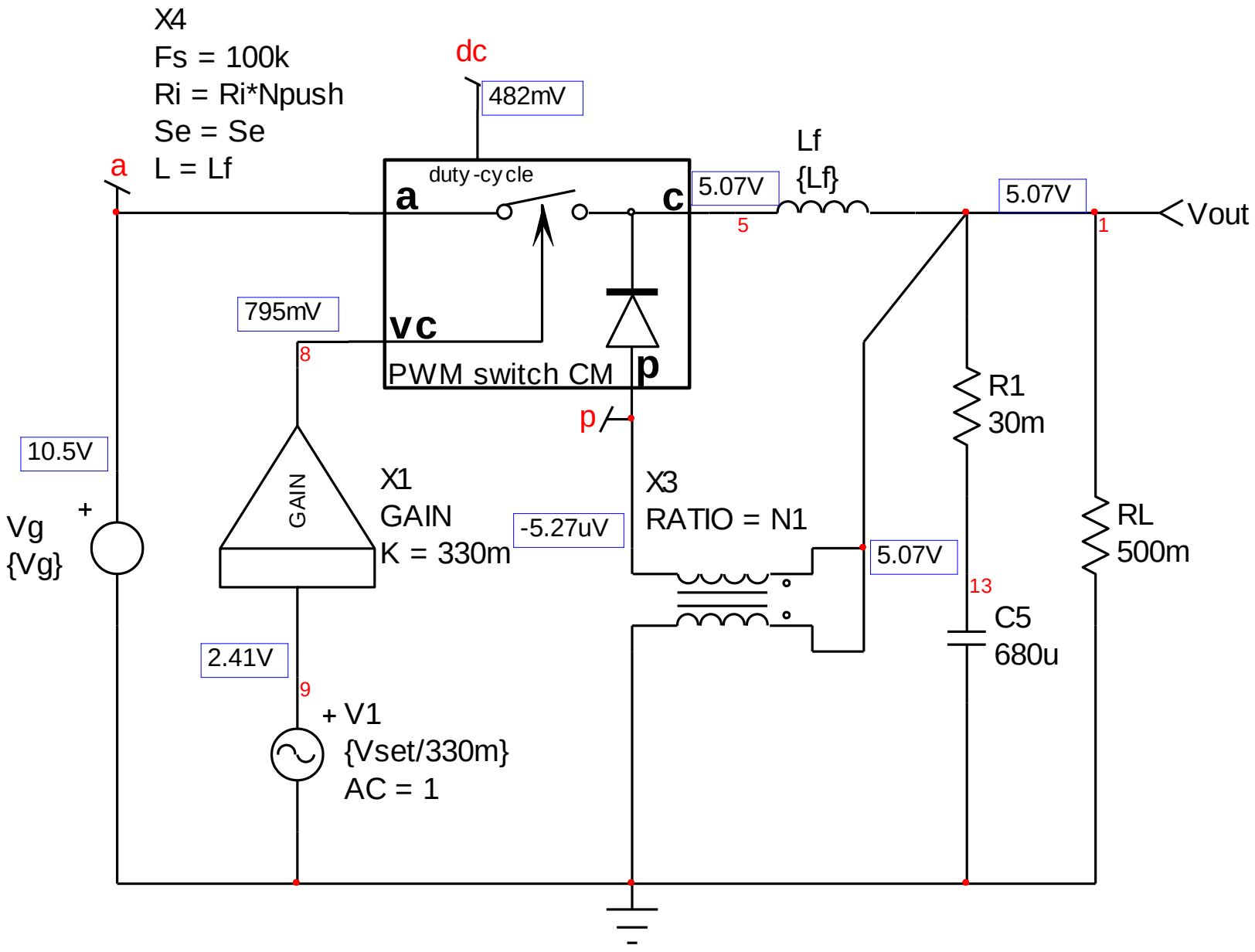
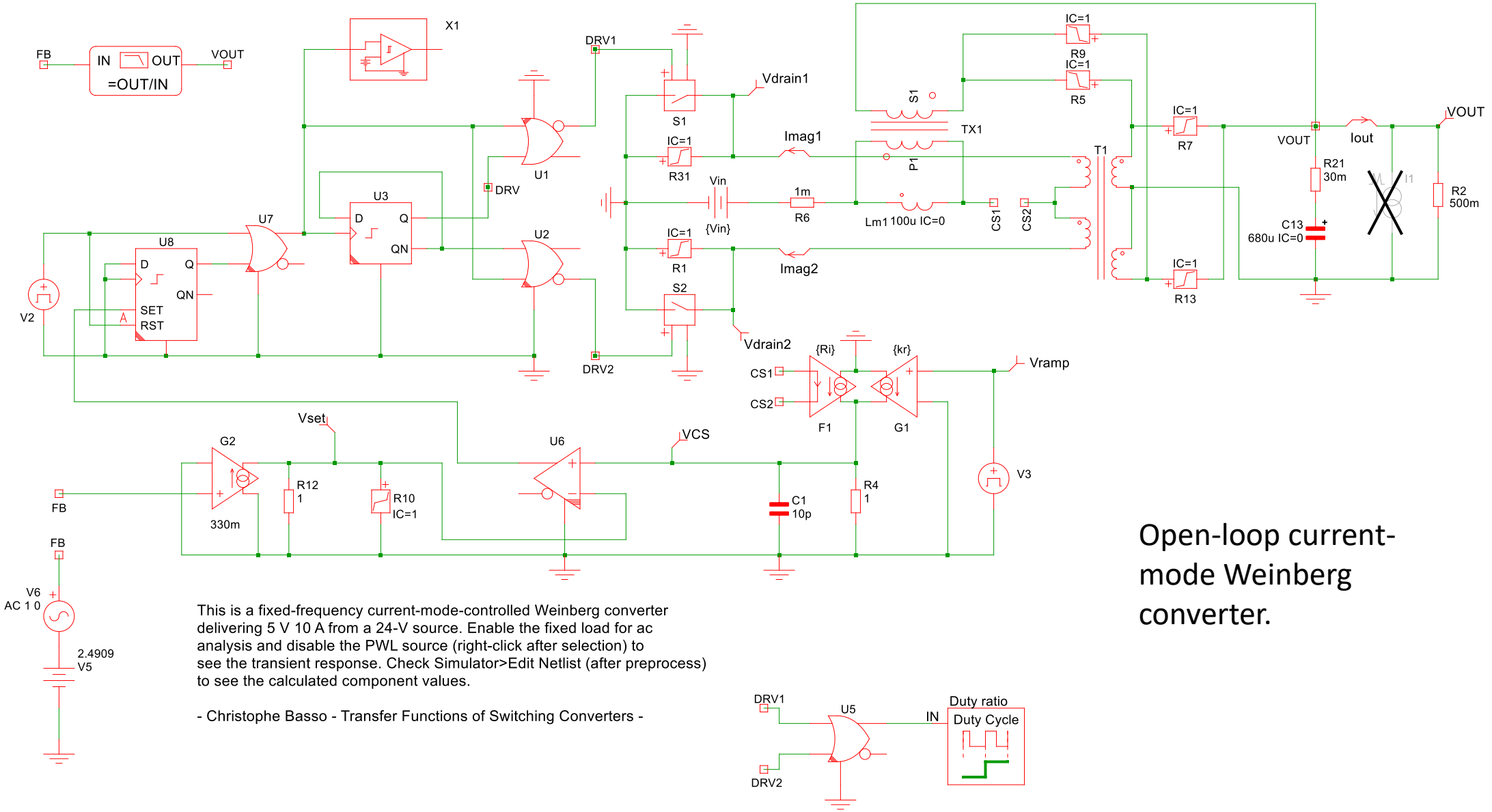
parameters

Vin=10
L1=100u
Nfly=700m
Npush=700m
Lf=L1*Npush^2
Vg=Vin*Npush
N1=(1/Npush)*Nfly
Ri=110m
Se=5.155k
Vset=823m

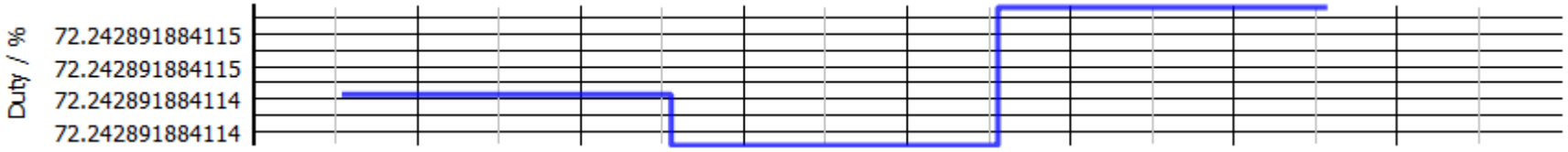




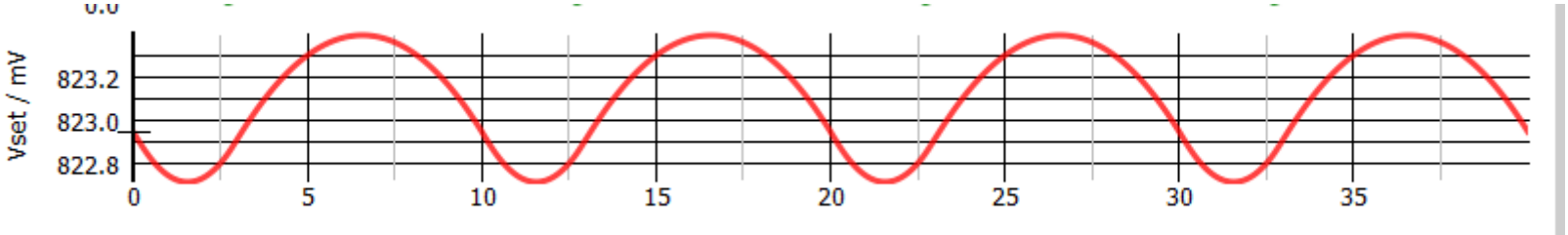
This is a fixed-frequency current-mode-controlled Weinberg converter delivering 5 V 10 A from a 24-V source. Enable the fixed load for ac analysis and disable the PWL source (right-click after selection) to see the transient response. Check Simulator>Edit Netlist (after preprocess) to see the calculated component values.

- Christophe Basso - Transfer Functions of Switching Converters -

Open-loop current-mode Weinberg converter.

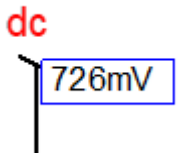


72.24% duty ratio

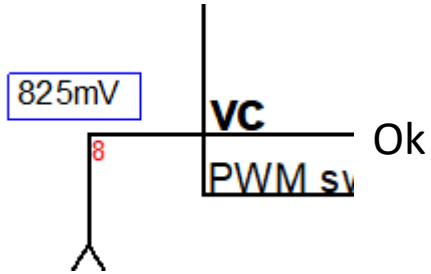


823 mV setpoint

```
* Rupper = 2500
* Rlower = 2500
* R2 = 12595.2431298727
* C2 = 1.8046242727999e-09
* C1 = 4.85475028859938e-09
* Boost = 35
* Fz = 2602.83525275873
* Fp = 9604.91063485583
* Sn = 3142.85714285714
* Se = 5855.14285714286
* D = 0.714285714285714
* Mc = 2.863
* kr = 0.0585514285714286
*
```

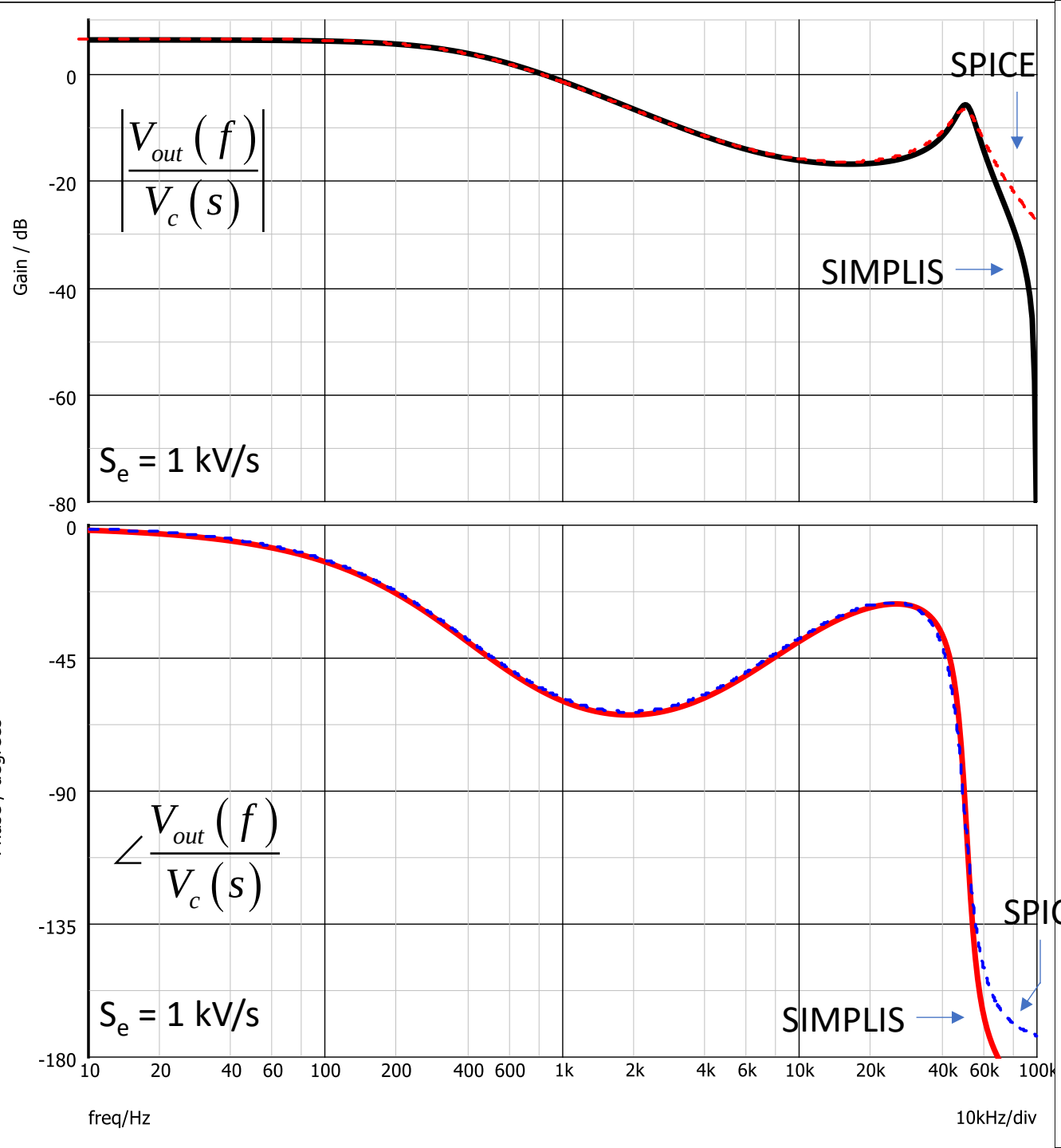


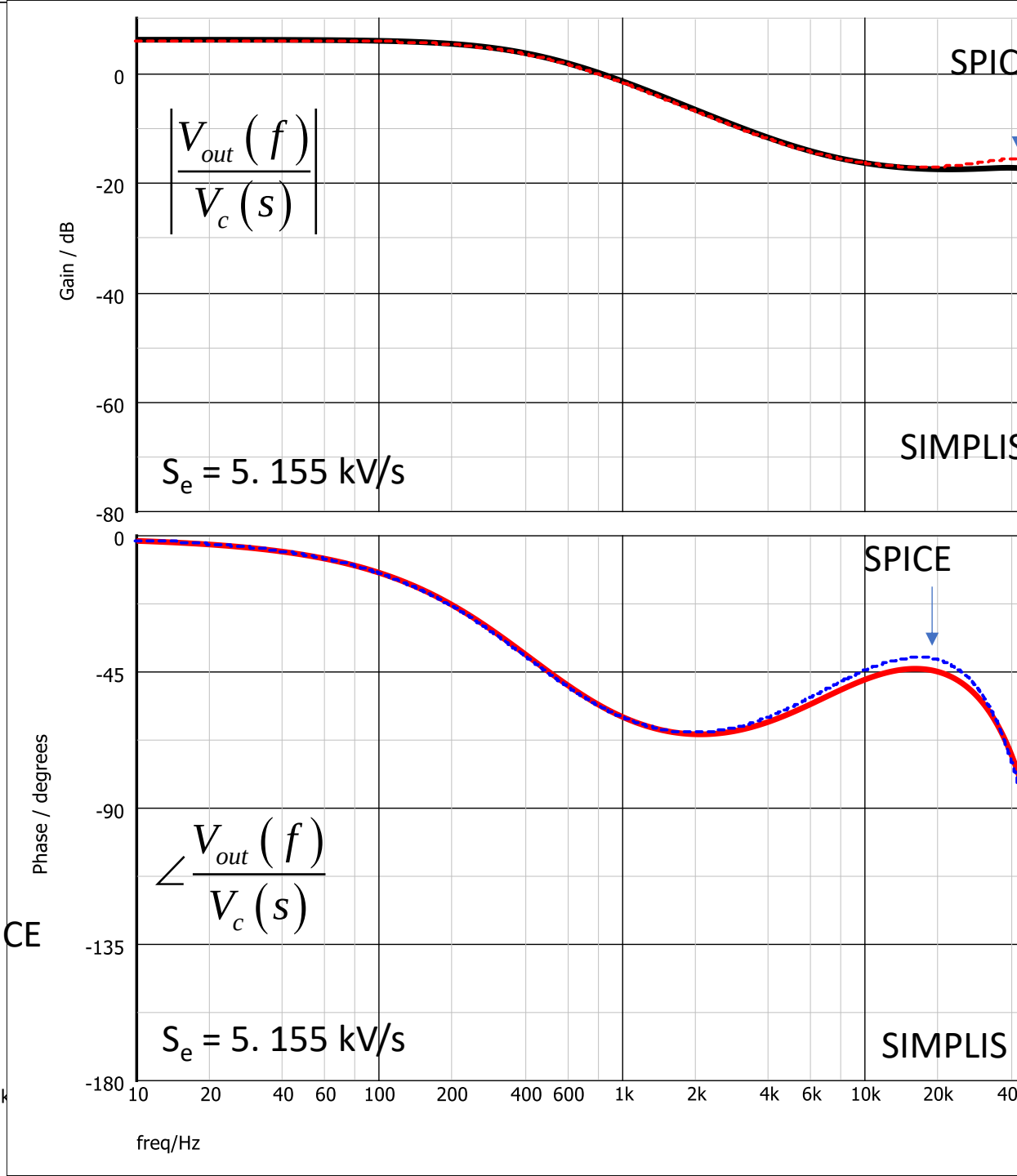
Ok



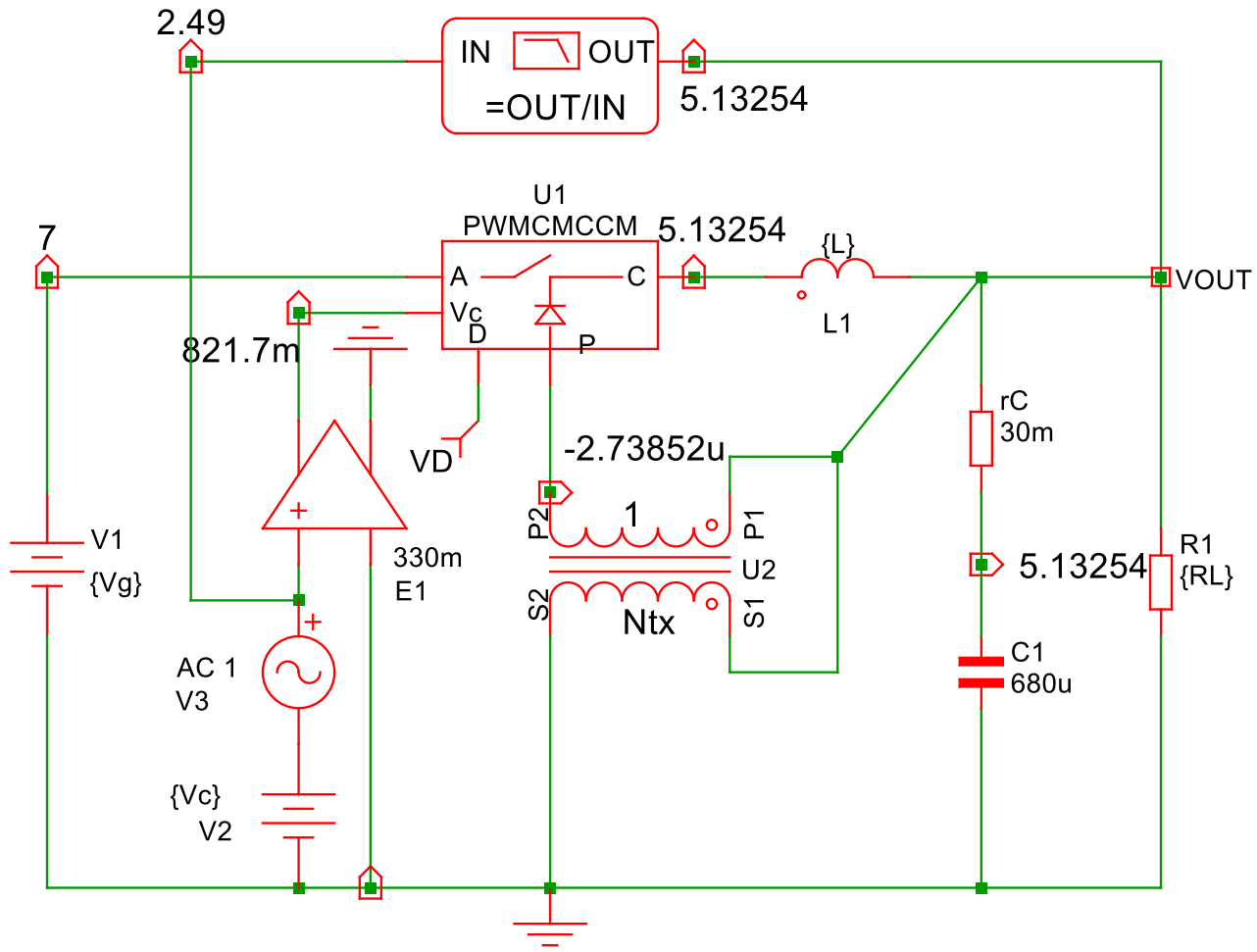
Ok

V_{in} = 10 V, S_e = 5.155 kV/s

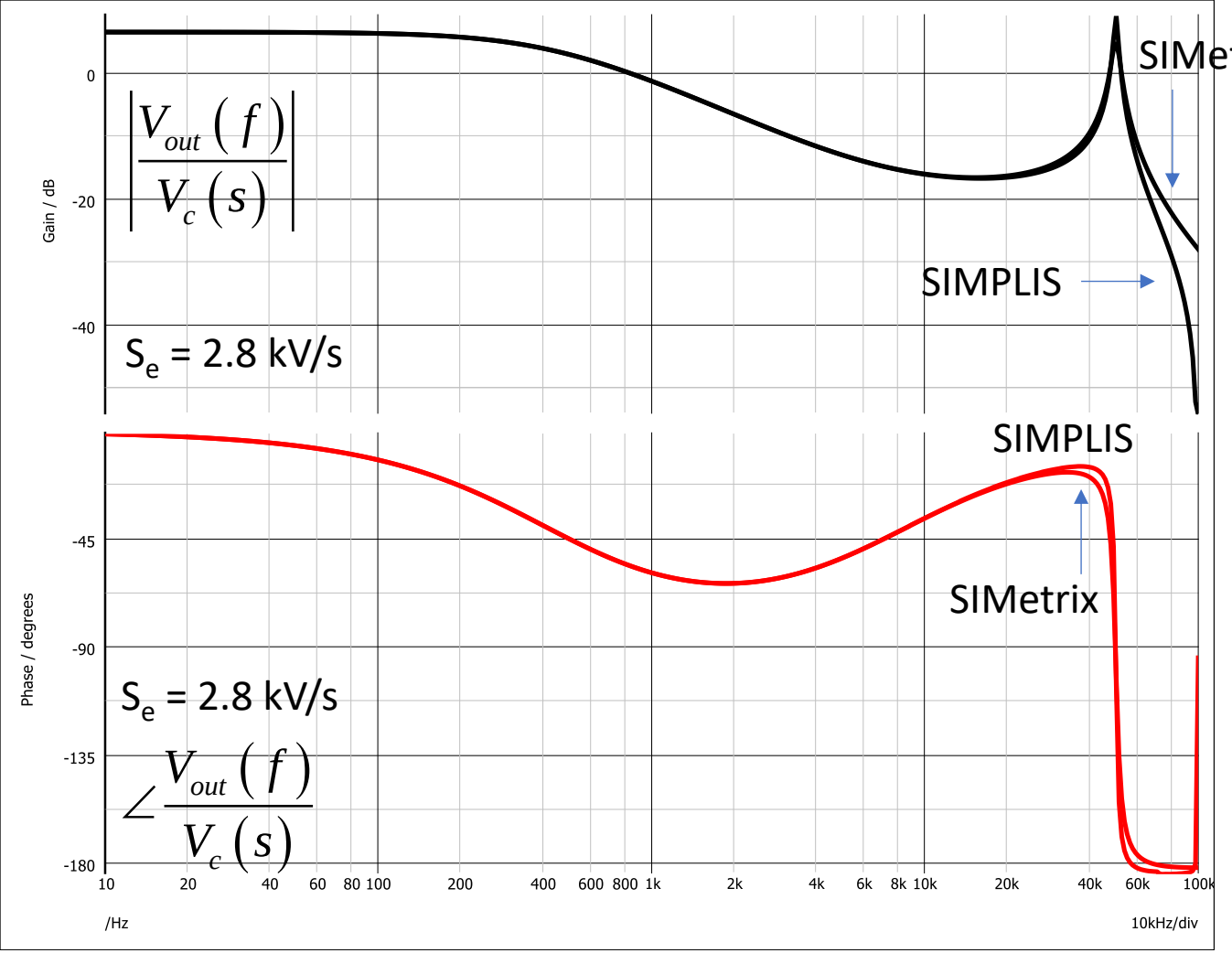

SPICE
SIMPLIS
$\left|\frac{V_{out}(f)}{V_c(s)}\right|$
S_e = 1 kV/s
Gain / dB
0
-20
-40
-60
-80
$\angle\frac{V_{out}(f)}{V_c(s)}$
S_e = 1 kV/s
SPICE
SIMPLIS
-45
-90
-135
-180
10
20
40
60
100
200
400
600
1k
2k
4k
6k
10k
20k
40k
60k
100k
freq/Hz
10kHz/div

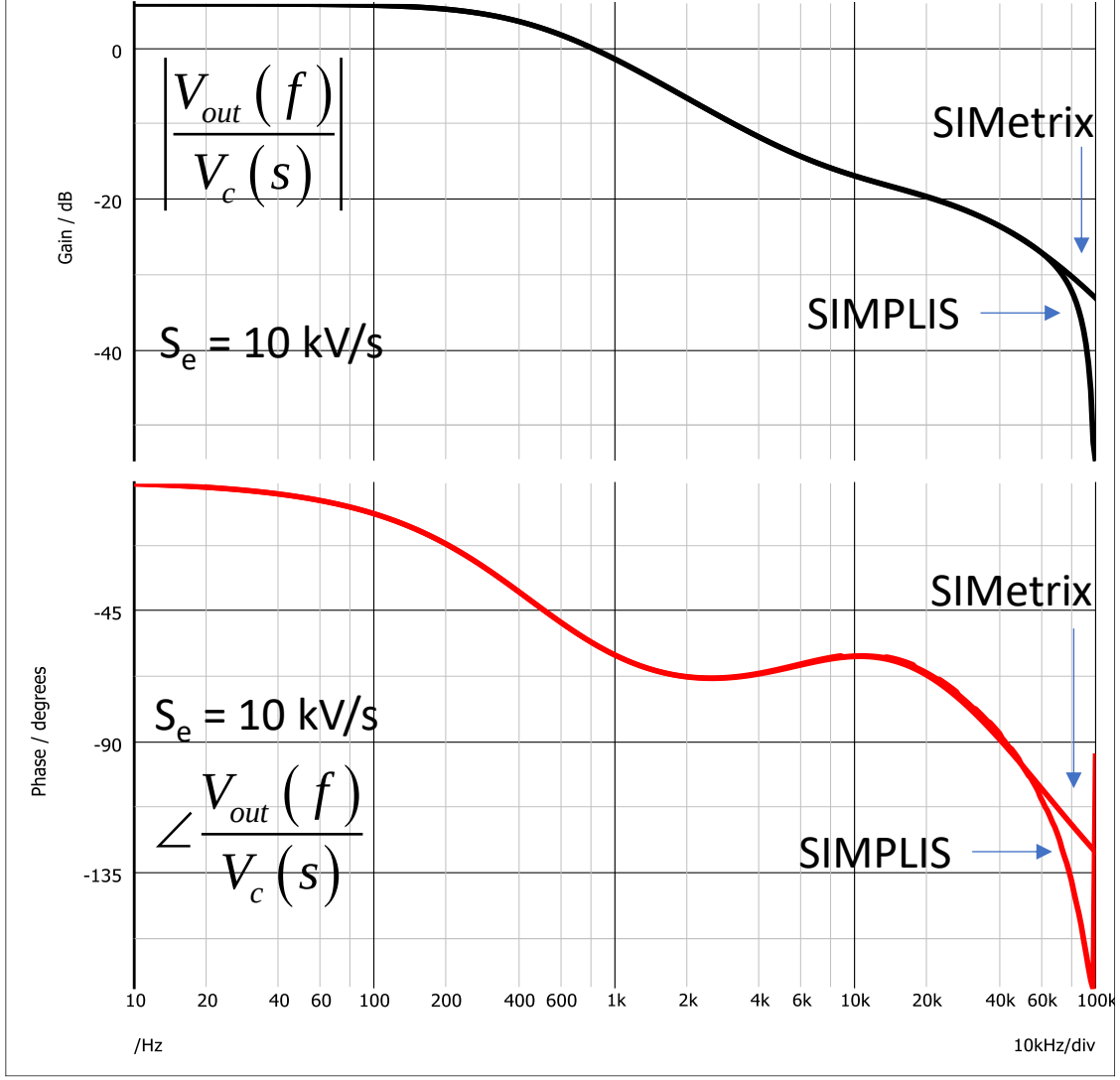

SPIC
SIMPLIS
$\left|\frac{V_{out}(f)}{V_c(s)}\right|$
S_e = 5. 155 kV/s
Gain / dB
0
-20
-40
-60
-80
$\angle\frac{V_{out}(f)}{V_c(s)}$
S_e = 5. 155 kV/s
SPICE
SIMPLIS
Phase / degrees
-45
-90
-135
-180
10
20
40
60
100
200
400
600
1k
2k
4k
6k
10k
20k
40
freq/Hz

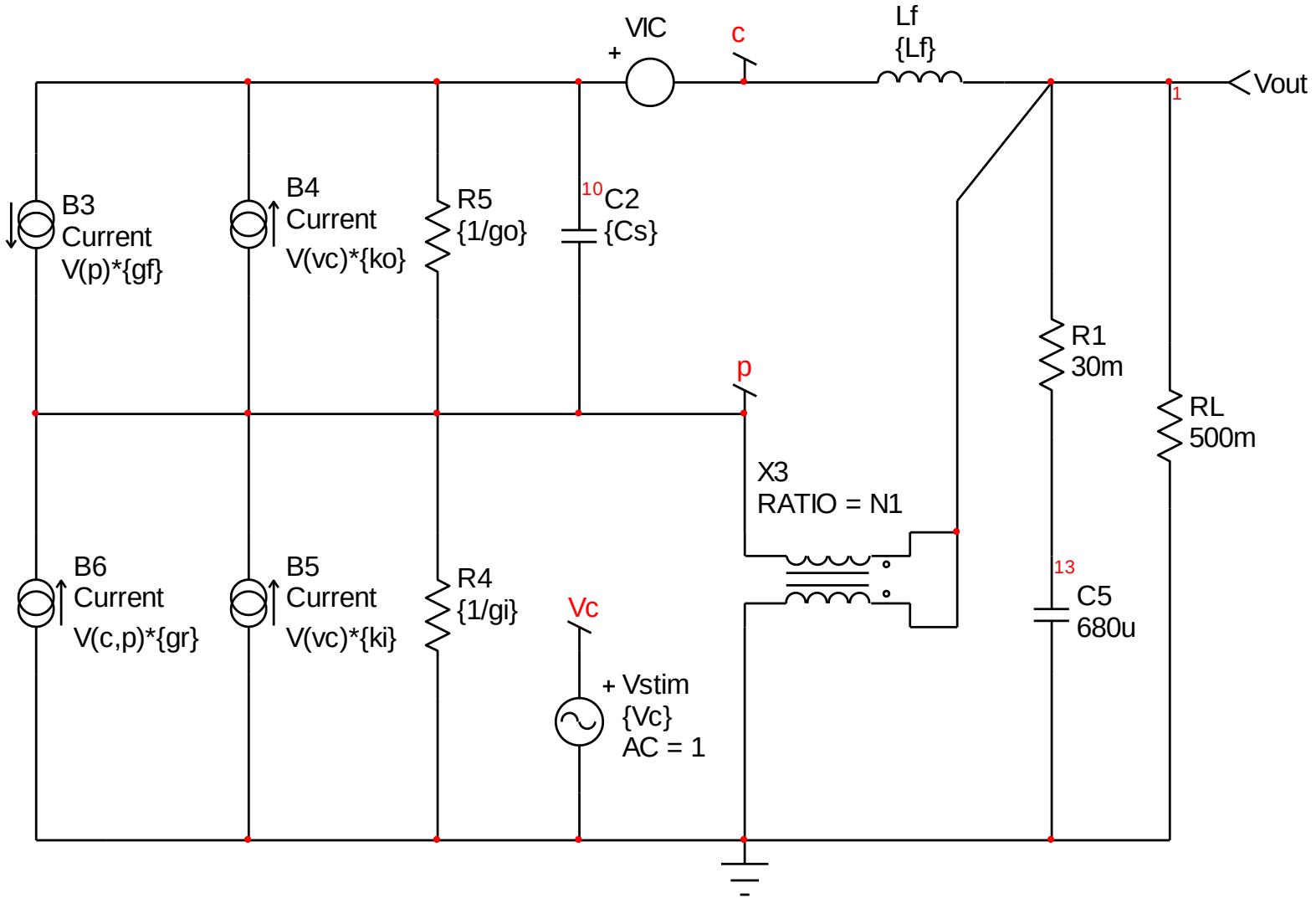
```
*
.param Vin=10
.param Vout=5
.param Fsw=100k
.param RL=500m
.param L1=100u
.param Nfly=700m
.param Npush=700m
.param L={L1*Npush^2}
.param Vg={Vin*Npush}
.param Ntx={(1/Npush)*Nfly}
.param Cs={1/(L*(Fsw*3.14)^2)}
.param Vc=2.49
.param Se=2.8k
.param Rsense=110m
.param Ri={Rsense*Npush}
*
* .param D={1/(1-(Nfly/Npush)+Nfly*(Vin/Vout))}
* .param Vap={Vout*Npush/(Nfly*D)}
* .param Ic={Vout^2/(RL*Vg*D)}
* .param Vout2={Vin*Npush*D/(D+(1-D)*Npush/Nfly)}
*
```



Current-mode average model built in SIMetrix


SIMetrix
SIMPLIS
$\left|\frac{V_{out}(f)}{V_c(s)}\right|$
S_e = 2.8 kV/s
Gain / dB
0
-20
-40
SIMPLIS
SIMetrix
$\angle\frac{V_{out}(f)}{V_c(s)}$
S_e = 2.8 kV/s
Phase / degrees
-45
-90
-135
-180
10 20 40 60 80 100 200 400 600 800 1k 2k 4k 6k 8k 10k 20k 40k 60k 100k
/Hz
10kHz/div


$\left|\frac{V_{out}(f)}{V_c(s)}\right|$
S_e = 10 kV/s
Gain / dB
0
-20
-40
SIMetrix
SIMPLIS
$\angle\frac{V_{out}(f)}{V_c(s)}$
S_e = 10 kV/s
Phase / degrees
-45
-90
-135
SIMetrix
SIMPLIS
10 20 40 60 100 200 400 600 1k 2k 4k 6k 10k 20k 40k 60k 100k
/Hz
10kHz/div



Small-signal model for the control-to-output determination of the CM Weinberg converter operated in CCM

parameters

Vin=10
Vout=5.27
L1=100u
Rsense=110m
Nfly=700m
Npush=700m
Lf=L1*Npush^2
Vg=Vin*Npush
N1=(1/Npush)*Nfly

Fsw=100kHz
Tsw=1/Fsw

Ri=Rsense*Npush
Se=0
L=Lf

Sn=(Vac/L)*Ri
Sf=(Vcp/L)*Ri

Cs=1/(L*(Fsw*3.14)^2)

Vc=822m

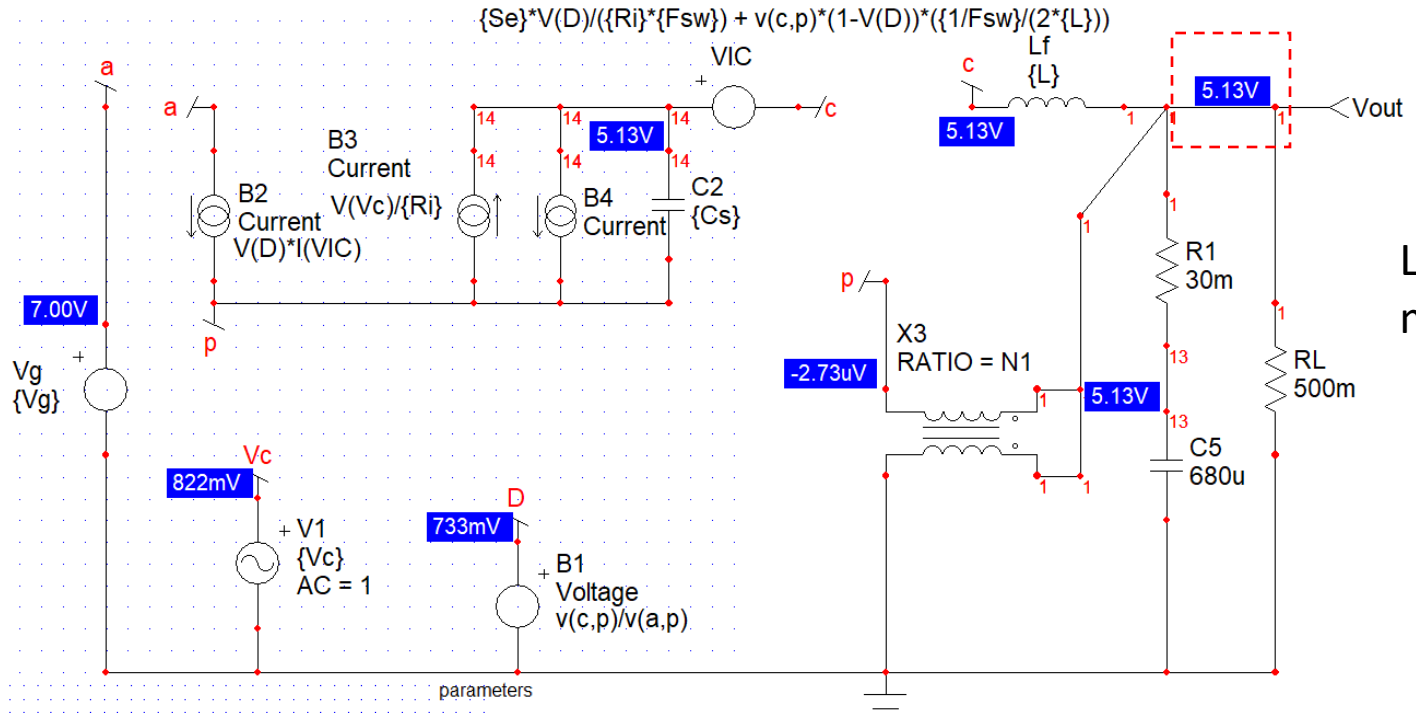
D=1/(1-(Nfly/Npush)+Nfly*(Vin/Vout))
Vap=Vout*Npush/(Nfly*D)
Vcp=Vout/N1
Vac=Vg-Vout

Ic=(Vc/Ri)-D*Tsw*Se/Ri-Vcp*(1-D)*Tsw/(2*L)

D'=1-D
ki=D/Ri
gi=D*(gf-Ic/Vap)
gr=(Ic/Vap)-go*D
ko=1/Ri
go=(Tsw/L)*(D'*Se/Sn+0.5-D)
gf=D*go-(D*D')*Tsw/(2*L)

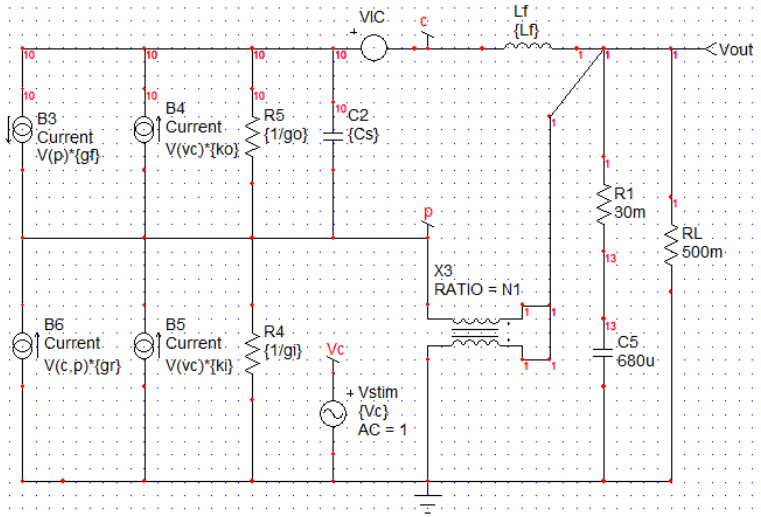
parameters

Vin=10
Fsw=100k
L1=100u
Nfly=700m
Npush=700m
L=L1*Npush^2
Vg=Vin*Npush
N1=(1/Npush)*Nfly
Rsense=110m
Ri=Rsense*Npush
Cs=1/(L*(Fsw*3.14)^2)
Se=2.8k
Vc=822m



Large-signal model

Small-signal model



parameters

Vin=10
Vout=5.13
L1=100u
Rsense=110m
Nfly=700m
Npush=700m
Lf=L1*Npush^2
Vg=Vin*Npush
N1=(1/Npush)*Nfly

Fsw=100kHz
Tsw=1/Fsw

Ri=Rsense*Npush
Se=2.8k
L=Lf

Sn=(Vac/L)*Ri
Sf=(Vcp/L)*Ri

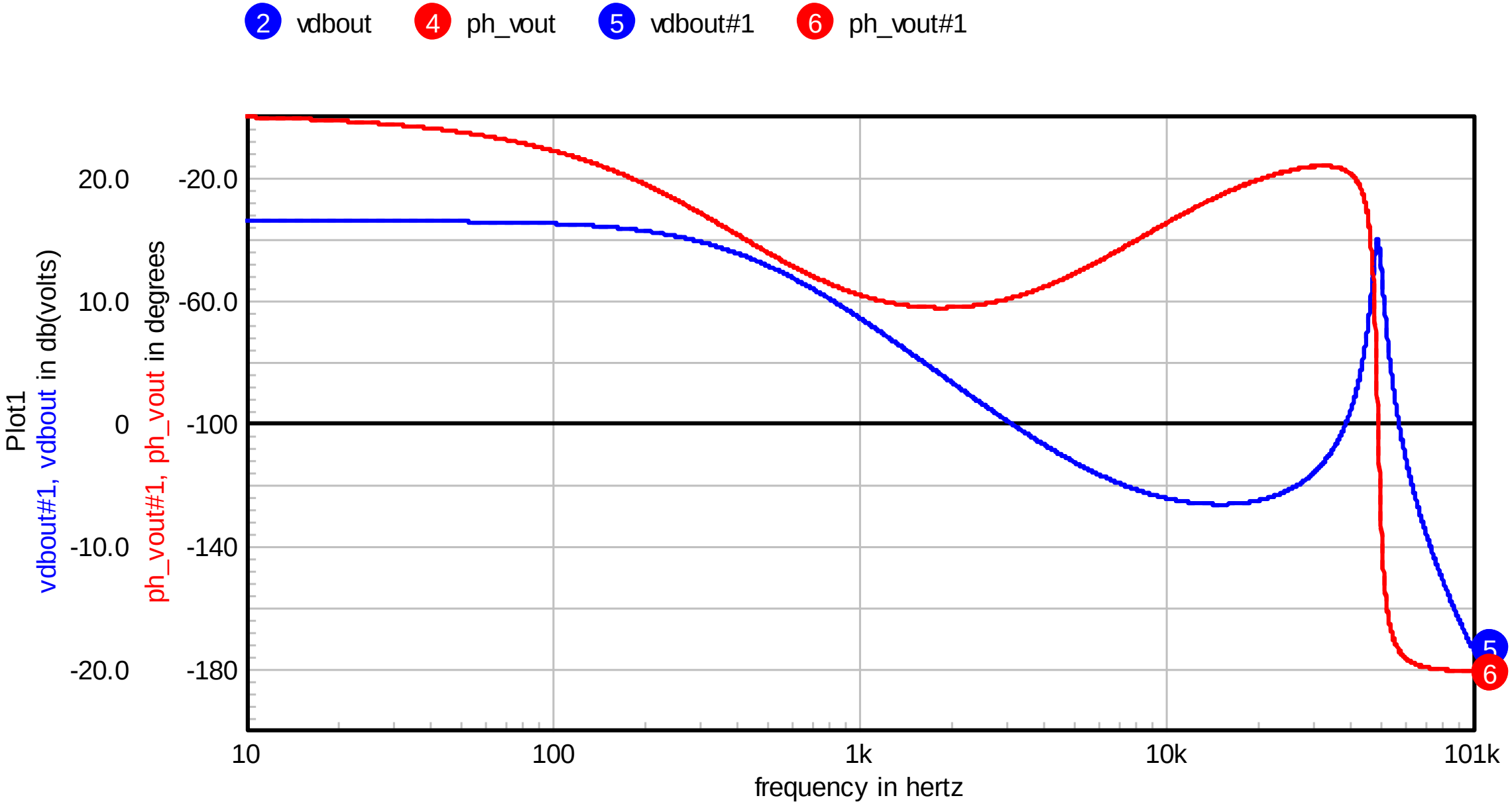
Cs=1/(L*(Fsw*3.14)^2)

Vc=822m

D=1/(1-(Nfly/Npush)+Nfly*(Vin/Vout))
Vap=Vout*Npush/(Nfly*D)
Vcp=Vout/N1
Vac=Vg-Vout

Ic=(Vc/Ri)-D*Tsw*Se/Ri-Vcp*(1-D)*Tsw/(2*L)

Operating parameters are the same, the output voltage obtained with the large-signal model is entered into the macro for auto-calculating all coefficients.



Ac responses from small- and large-signal models are rigorously identical: good to go!