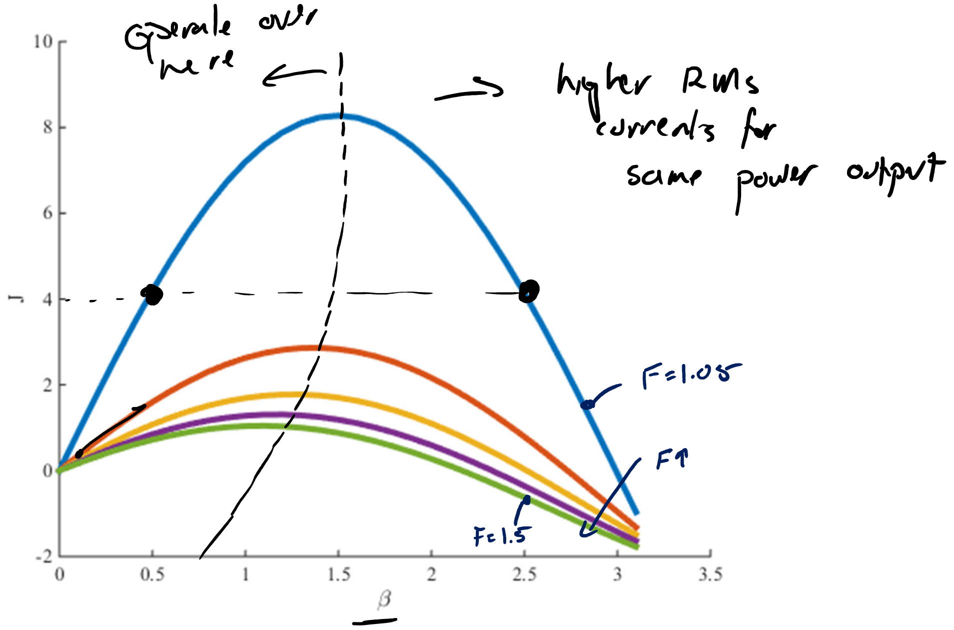
SRC Control Trajectory

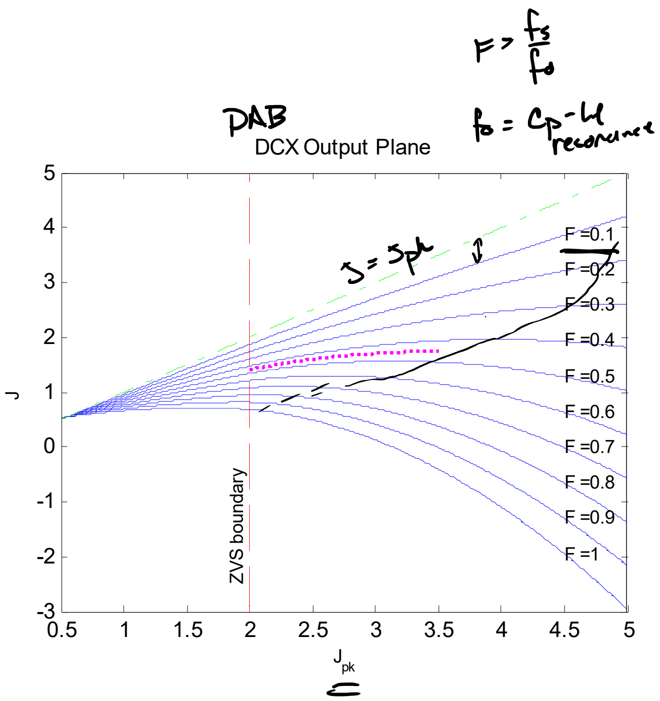
Normally want to operate with F ≥ 1
in SRC

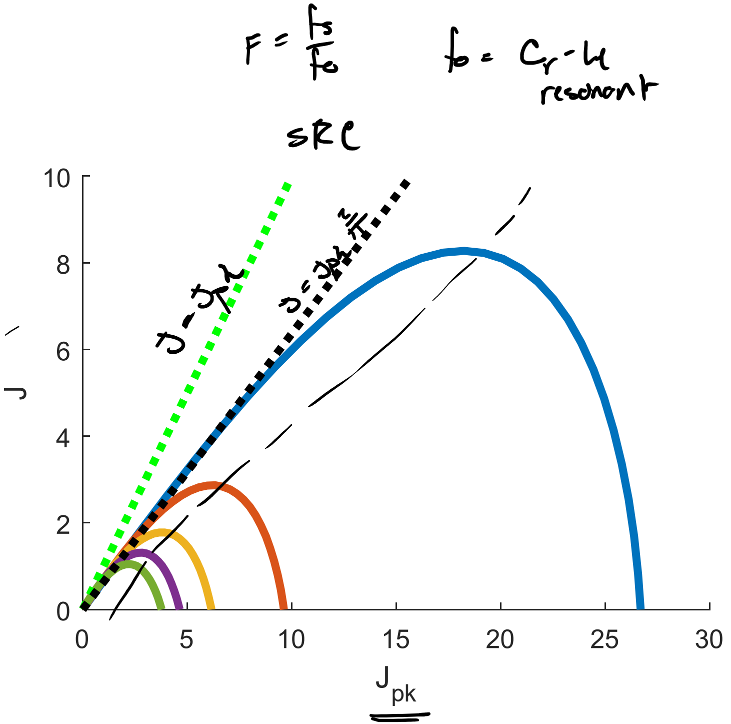
$F = \frac{f_s}{f_o} \geq 1$ $f_s \geq f_o$

→ Gives possibility of ZVS

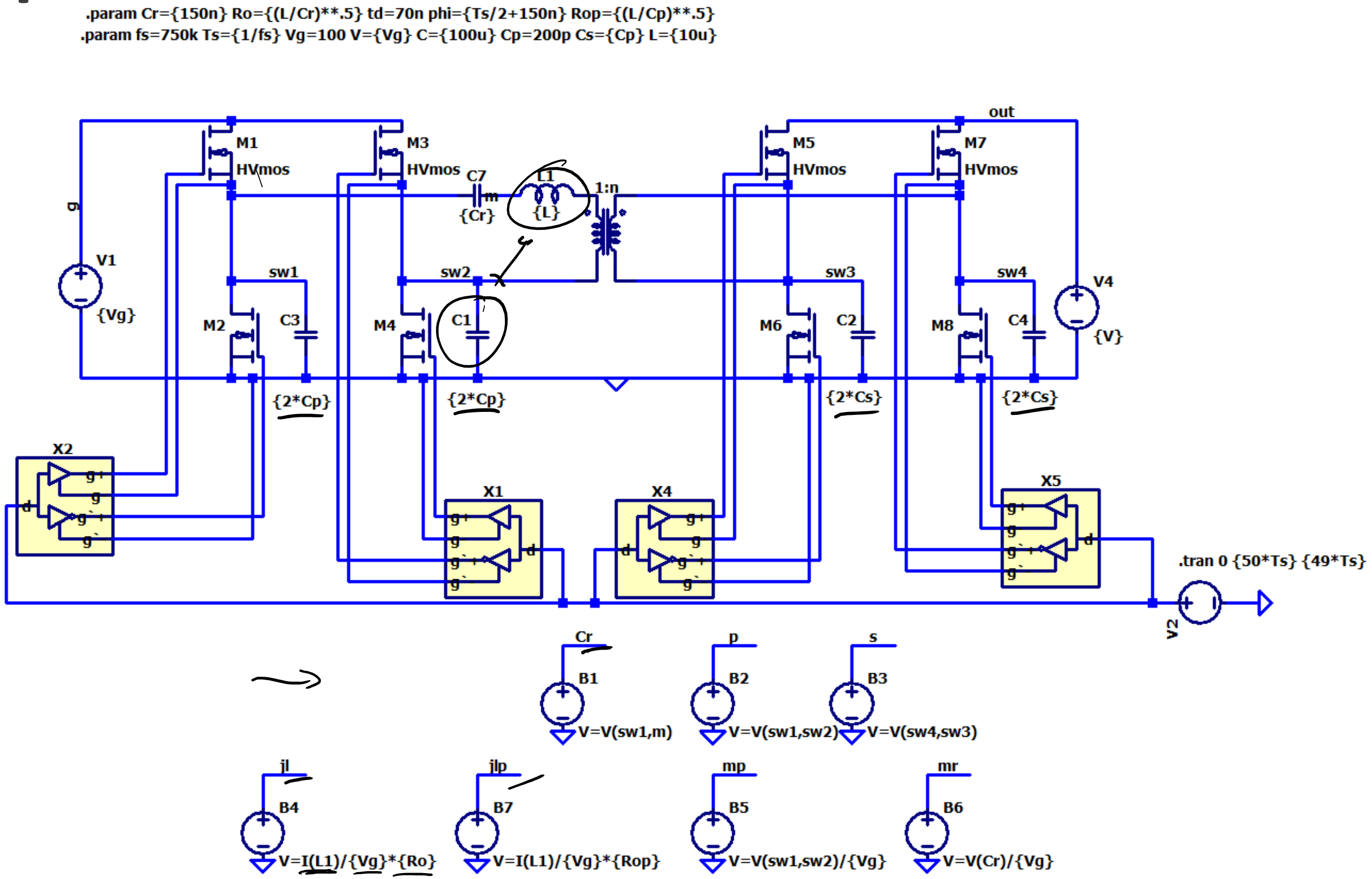


SRC Current Stress



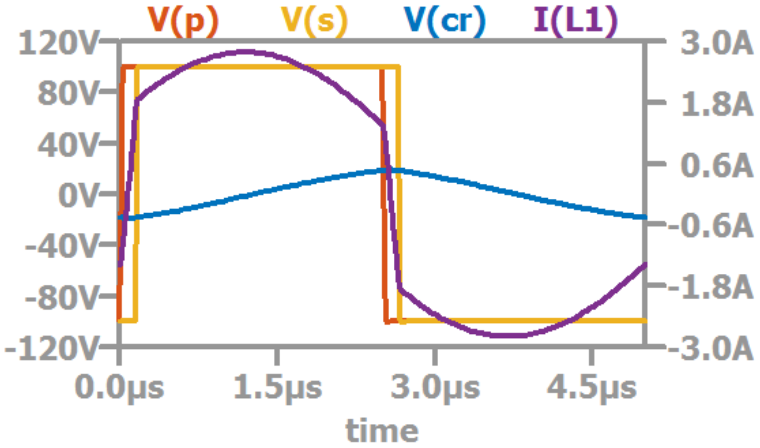


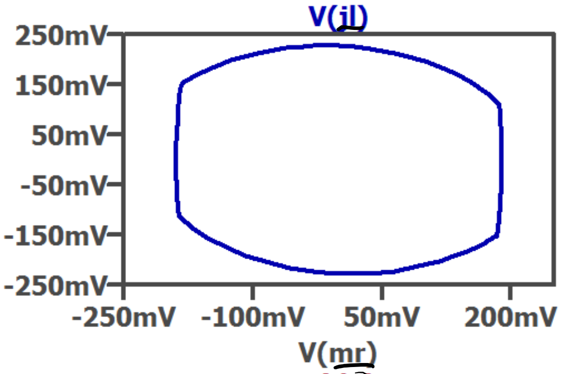
Example Simulation

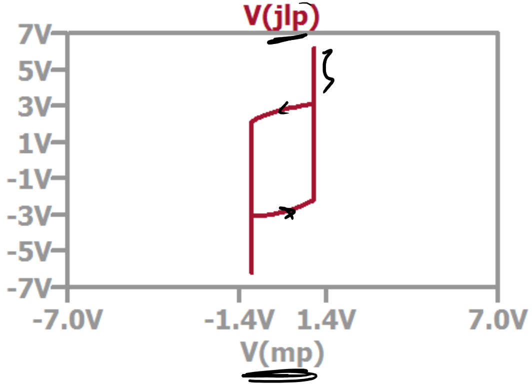


SRC Simulation

- I_{out} = 2A
- f_s = 200kHz
- f_o = 130kHz
- V_g = 100V
- V_{out} = 100V

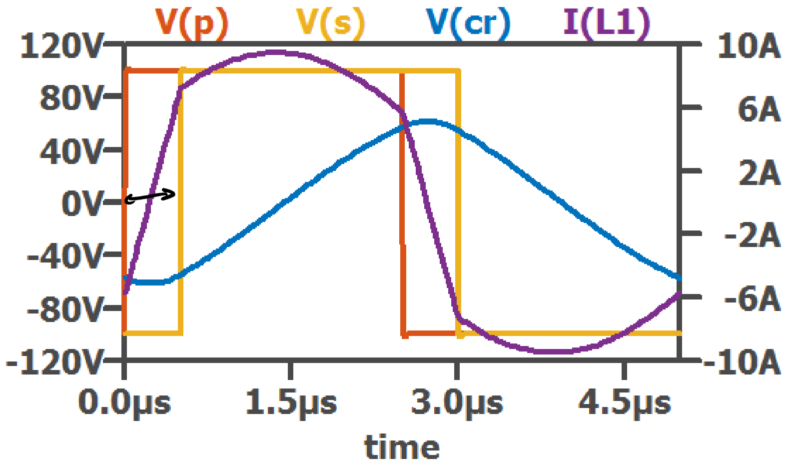


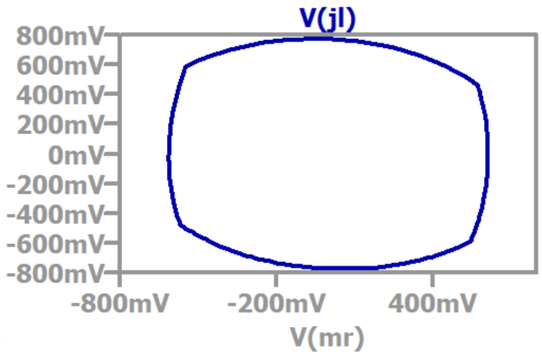


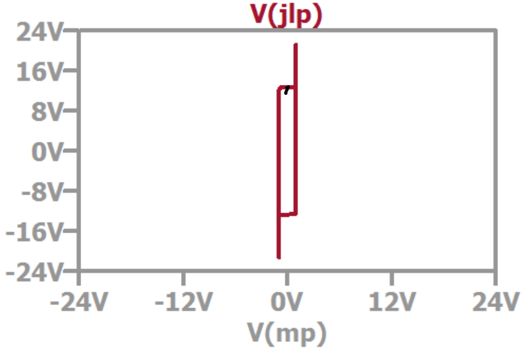


SRC Simulation

I_{out} = 6.5A
f_s = 200kHz
f_o = 130kHz
V_g = 100V
V_{out} = 100V

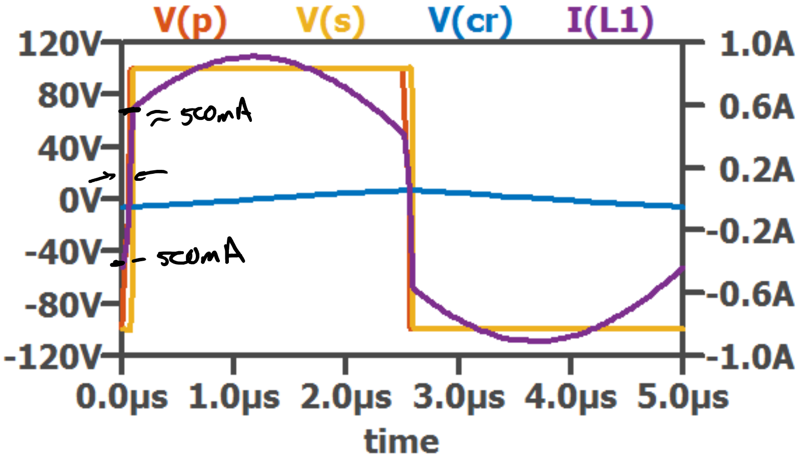


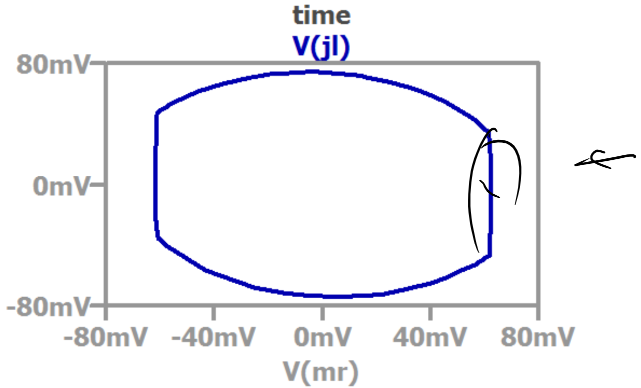


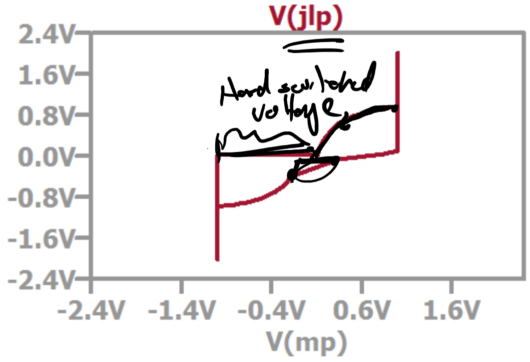


SRC Simulation

I_{out} = 500mA
f_s = 200kHz
f_o = 130kHz
V_g = 100V
V_{out} = 100V



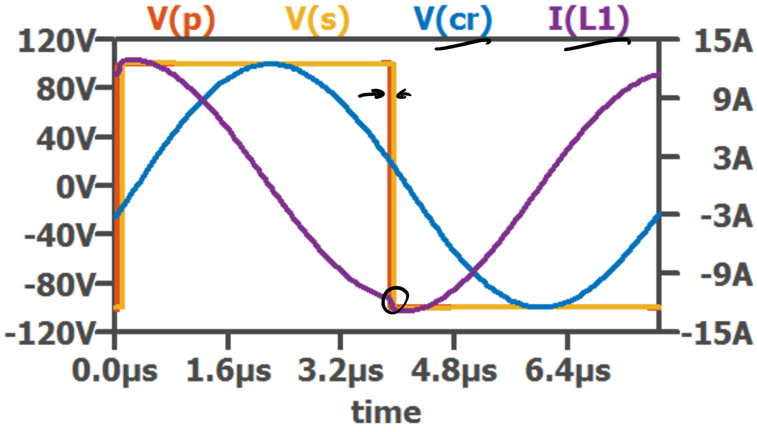


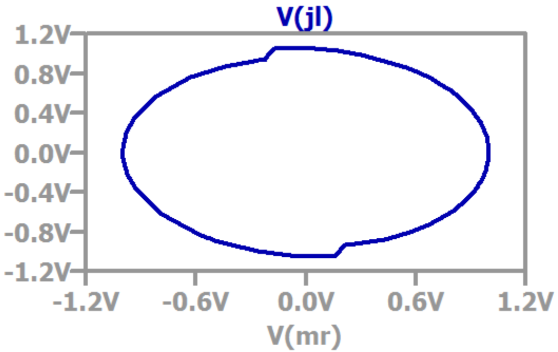


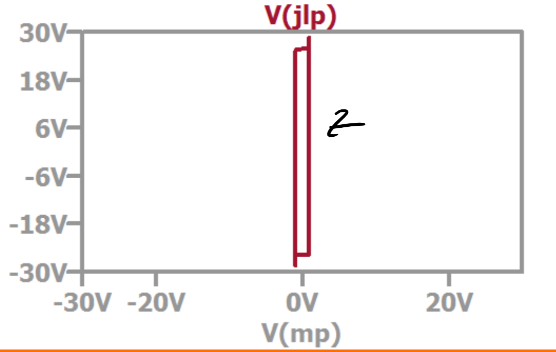
SRC Simulation

I_{out} = 1.2A
f_s = 130kHz
f_o = 130kHz
V_g = 100V
V_{out} = 100V

F = 1

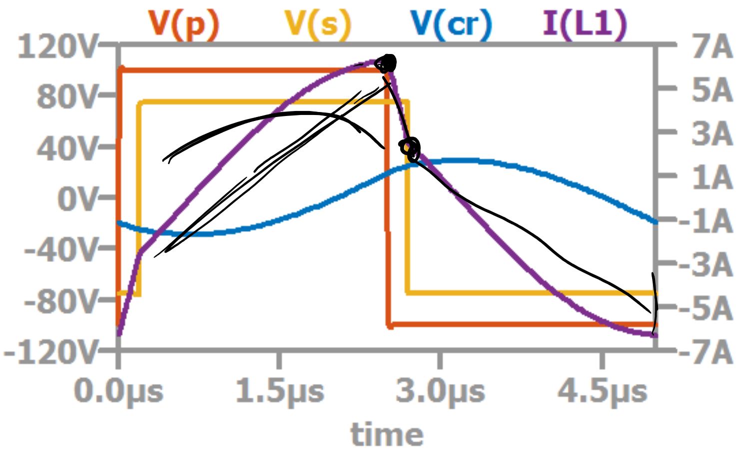


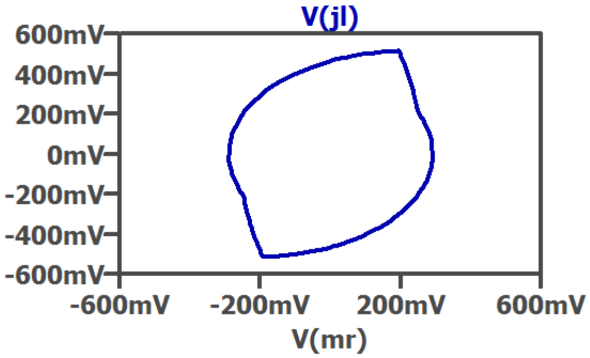


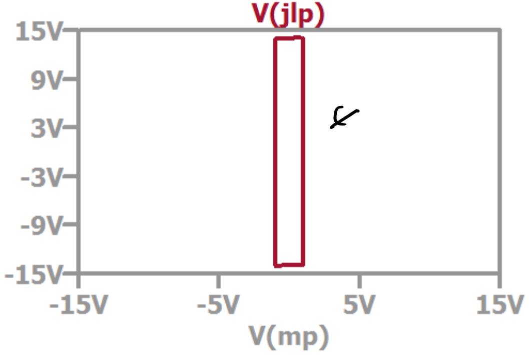


SRC Simulation

I_{out} = 3A
f_s = 200kHz
f_o = 130kHz
V_g = 100V
V_{out} = 75V

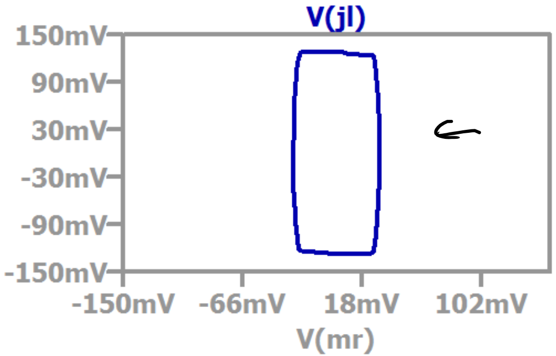


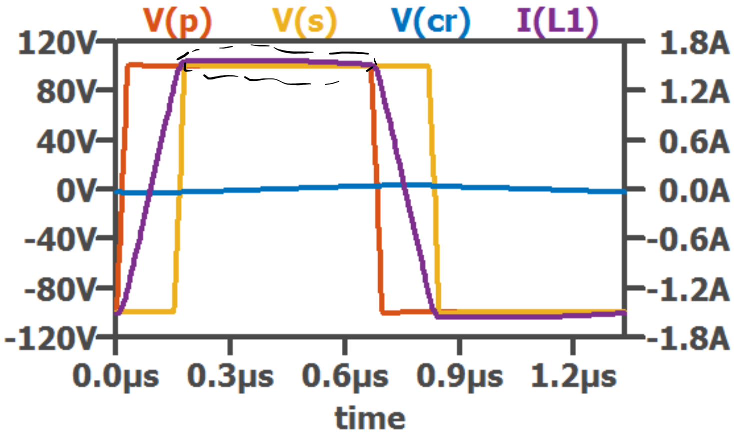


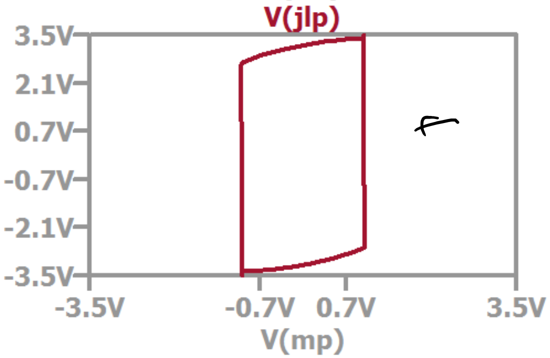


SRC Simulation

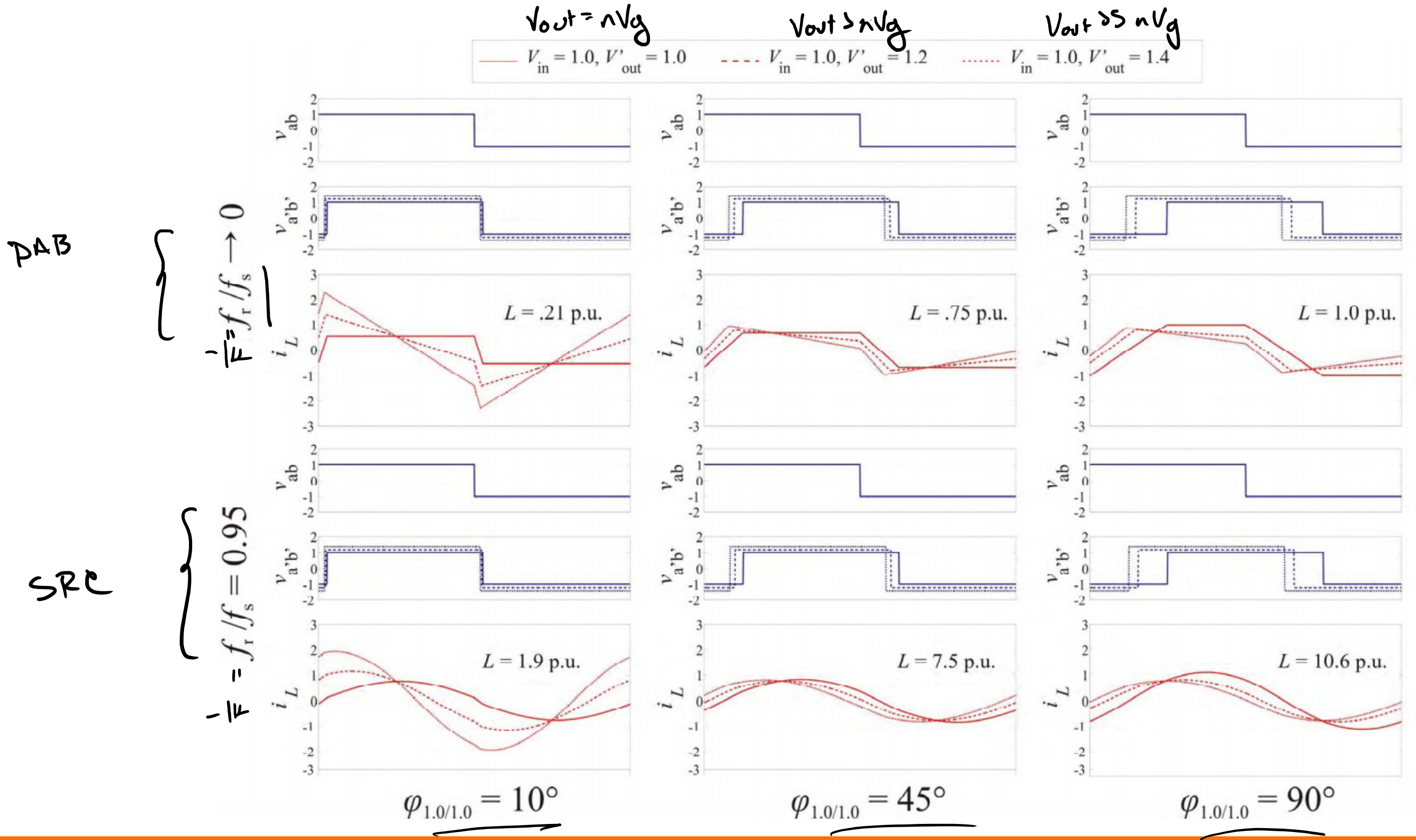
I_{out} = 1A
f_s = 750kHz
f_o = 130kHz
V_g = 100V
V_{out} = 100V



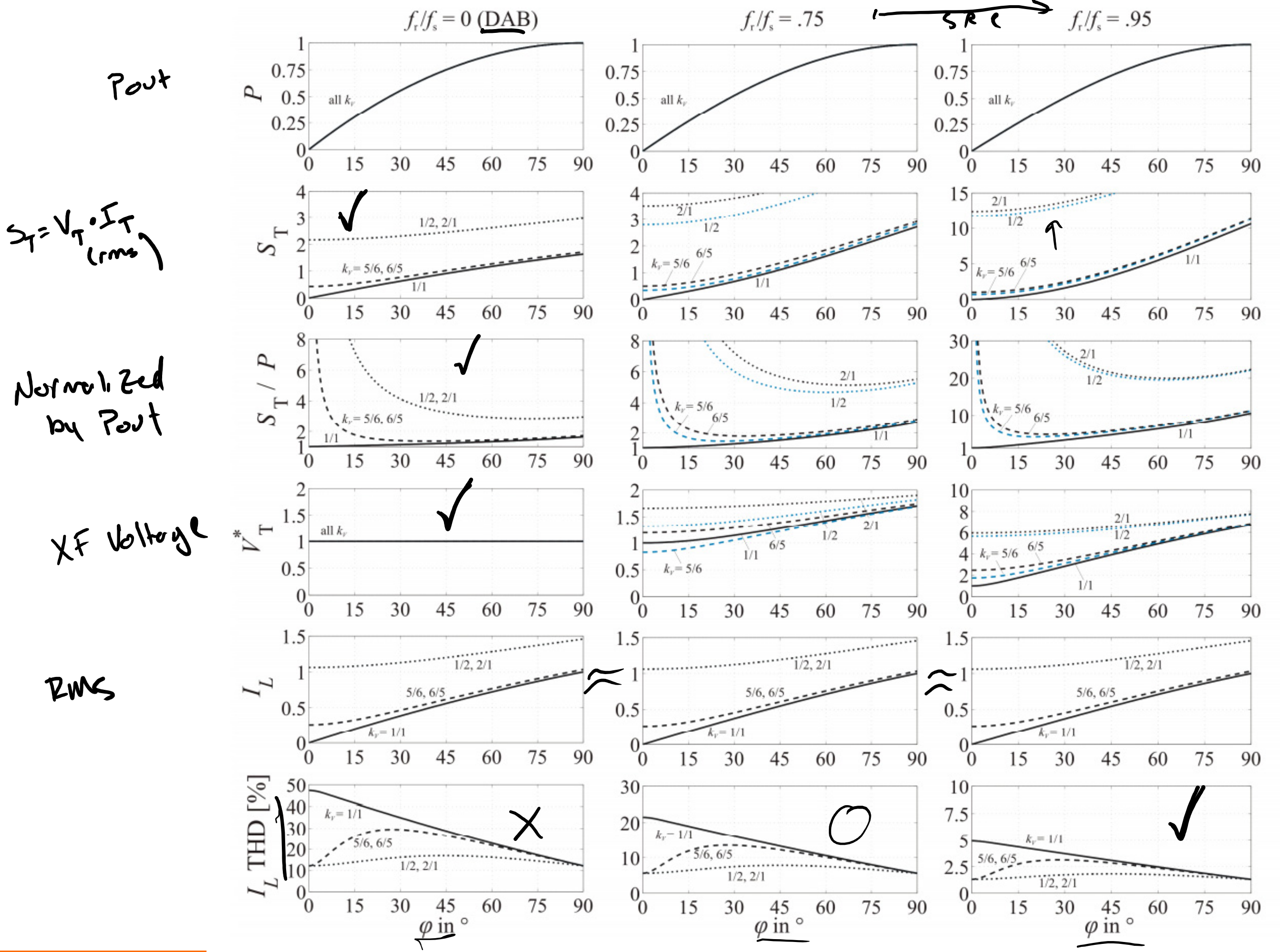




DAB vs SRC



Vout = nVg
Vout > nVg
Vout >> nVg
V_in = 1.0, V'_out = 1.0
V_in = 1.0, V'_out = 1.2
V_in = 1.0, V'_out = 1.4
DAB
SRC
F = f_r/f_s → 0
F = f_r/f_s = 0.95
v_ab
v_a'b'
i_L
L = .21 p.u.
L = .75 p.u.
L = 1.0 p.u.
L = 1.9 p.u.
L = 7.5 p.u.
L = 10.6 p.u.
φ_1.0/1.0 = 10°
φ_1.0/1.0 = 45°
φ_1.0/1.0 = 90°



R. Lenke, F. Mura and R. W. De Doncker, "Comparison of non-resonant and super-resonant dual-active ZVS-operated high-power DC-DC converters,"

DAB vs SRC: Conclusions

DAB

+ Smaller resonant tank
+ Smaller RMS currents
+ Wider Soft-switching range

SRC

+ Can be designed with larger XF inductance
+ Lower AC winding losses
+ Reduced device turn-off losses