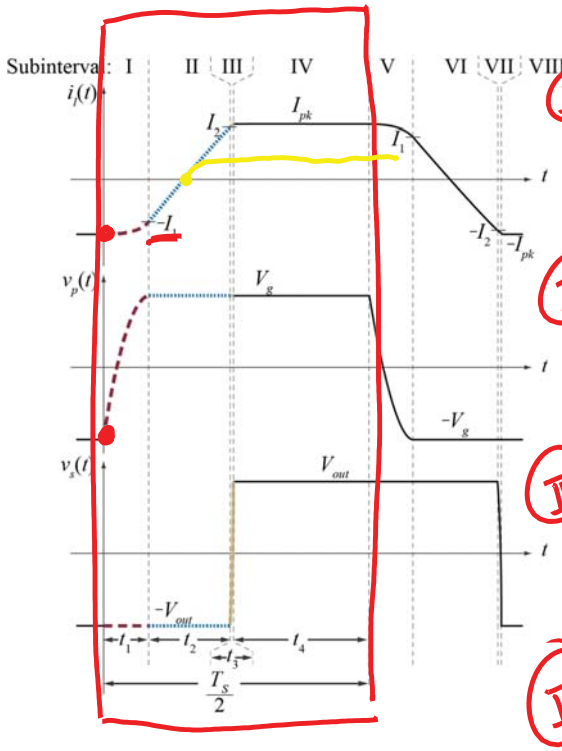
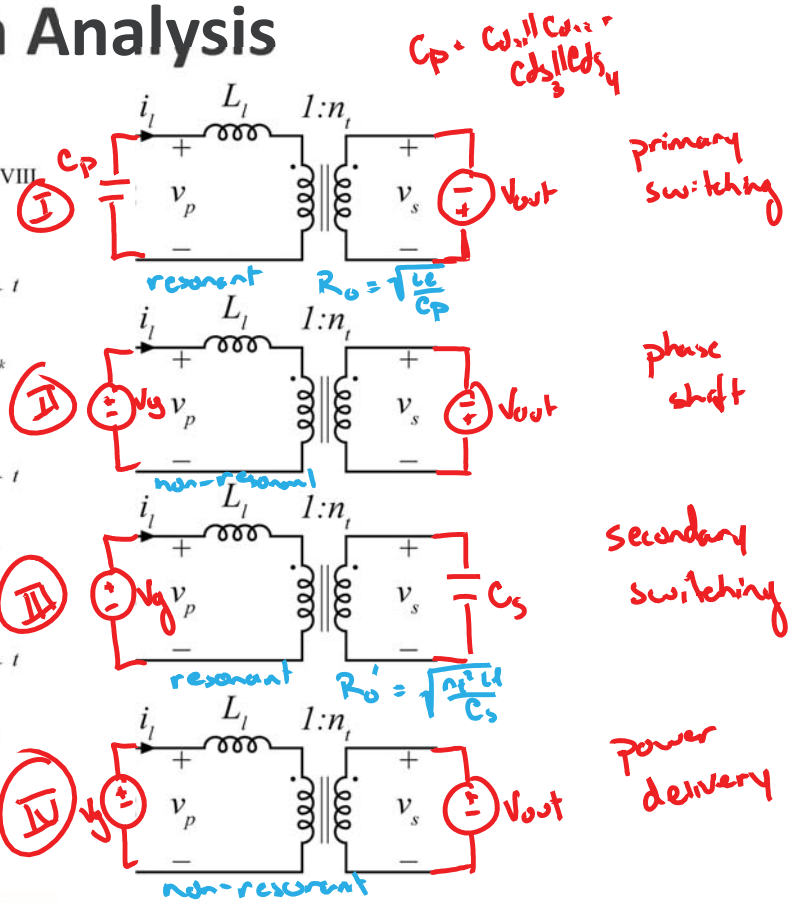
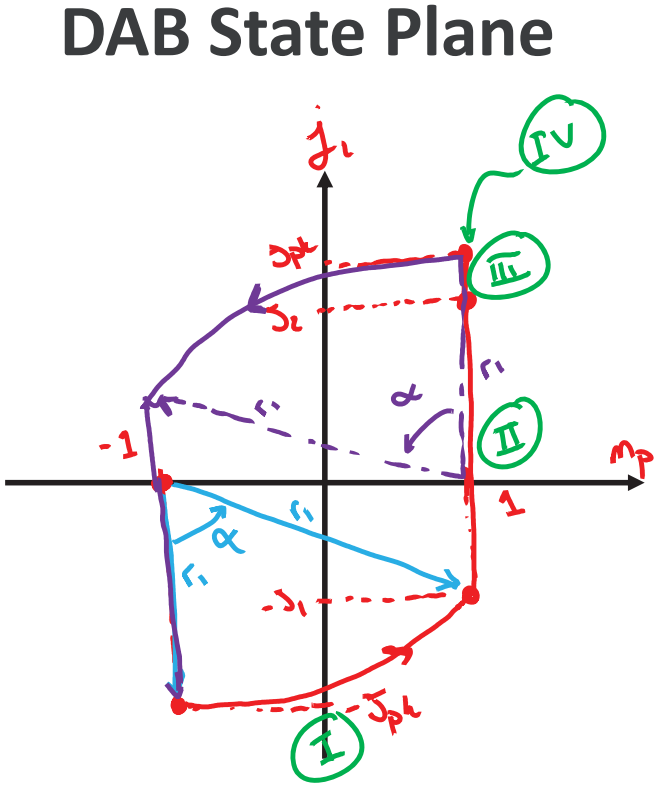
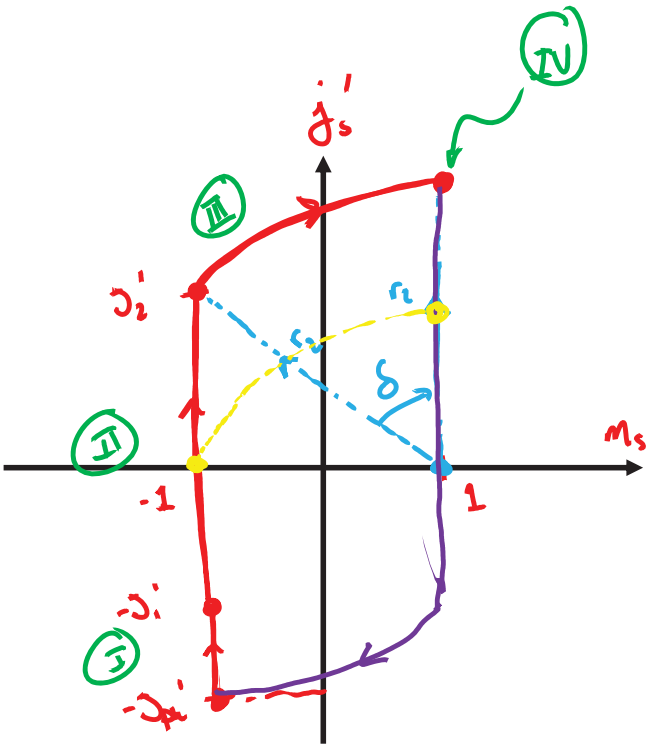
DAB Operation Analysis





DAB State Plane

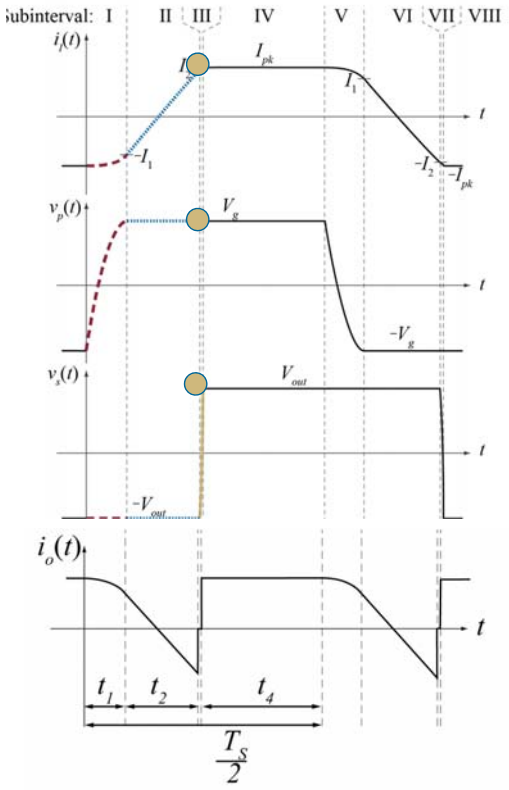




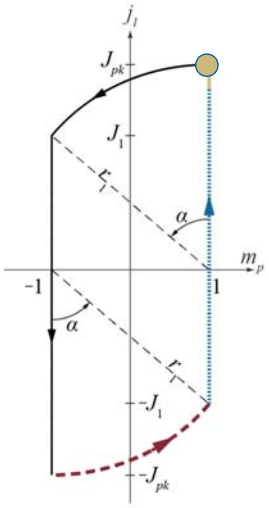
$V_{base} = V_g$, $I_{base} = \frac{V_g}{\sqrt{L_l/C_p}}$

$V_{base} = n_t V_g = V_{out}$, $I_{base} = \frac{V_{out}}{\sqrt{n_t^2 L_l / C_s}}$

State Plane Analysis of DAB Converter

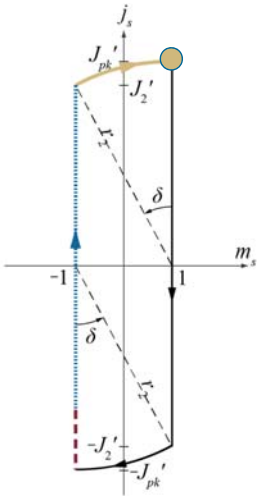


Primary



$$I_{base} = V_g \sqrt{\frac{C_p}{L_l}}$$

Secondary



$$I_{base} = V_g \sqrt{\frac{C_s}{n_t^{\,2} L_l}}$$

ZVS Condition

Primary:

$r_1 = J_{pk} > 2$

$\frac{I_{pk}}{I_{base}} > 2 \rightarrow \frac{I_{pk}}{V_g}\sqrt{\frac{L_l}{C_p}} > 2$

$(I_{pk})^2 L_l > (2V_g)^2 C_p$

- will lose ZVS at light load.
- want large L_l for a wide ZVS range

Secondary:

Can always achieve ZVS in this mode of operation

State Plane Solution

(I) $J_{pk} = \sqrt{J_1^2 + 4}$

$\alpha = \tan^{-1}\left(\frac{2}{J_1}\right) = \sin^{-1}\left(\frac{2}{J_{pk}}\right)$

(II) $\frac{2V_g}{L_l} t_2 = I_1 - I_2$

$2\theta_2 = J_1 + J_2$

(III) $J_{pk}' = \sqrt{J_2'^2 + 4}$

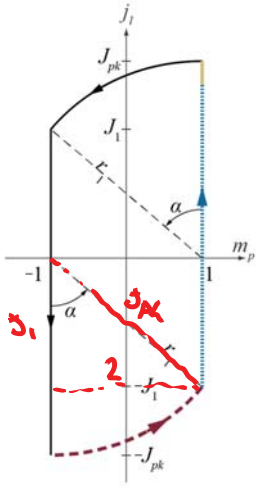
$\delta = \tan^{-1}\left(\frac{2}{J_2'}\right)$

(IV) ✗

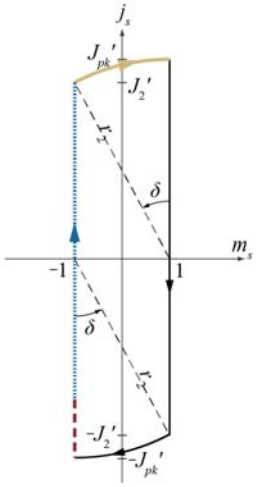
$\frac{T_2}{2} = t_1 + t_2 + t_3 + t_4$

$\frac{\pi}{F} = \alpha + \theta_2 + \delta + \theta_4$

Primary



Secondary



$$I_{base} = V_g \sqrt{\frac{C_p}{L_l}}$$

$$I_{base} = V_g \sqrt{\frac{C_s}{n_t^{\,2} L_l}}$$