$V_{base} = V_{DC}$

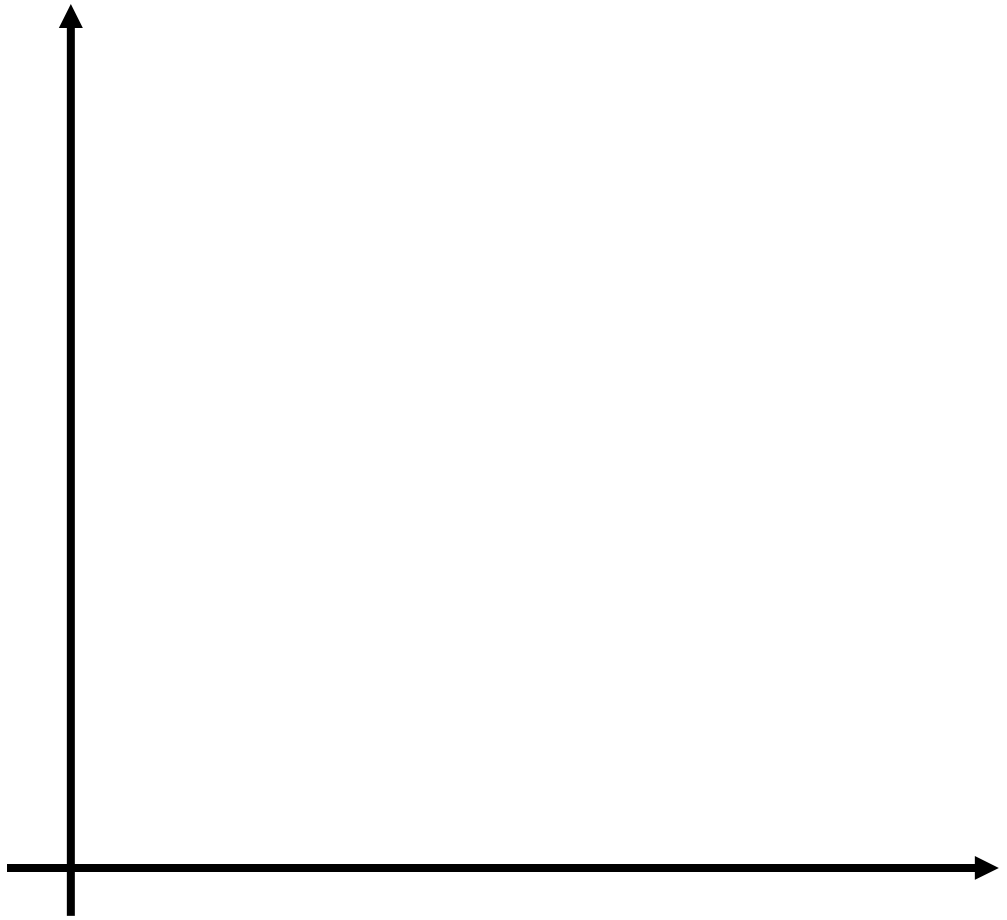
$I_{base} = \frac{V_{DC}}{R_0}$

$$\begin{cases} v_c(t) = V_{DC} + (V_0 - V_{DC})\cos(\omega_0 t) + R_0(I_0 - I_{DC})\sin(\omega_0 t) \\ i_L(t) = I_{DC} + (I_0 - I_{DC})\cos(\omega_0 t) + \frac{1}{R_0}(V_{DC} - V_0)\sin(\omega_0 t) \end{cases}$$

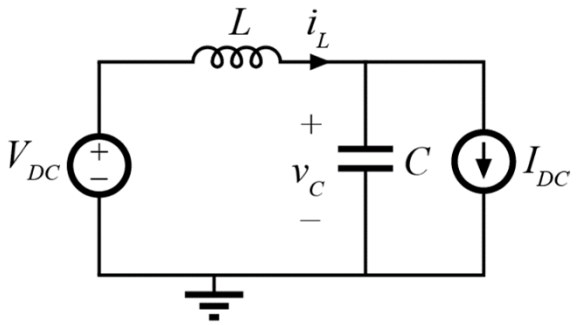
$\frac{R_0}{V_{base}}(I_0 - I_{DC}) = \frac{I_0 - I_{DC}}{I_{base}}$

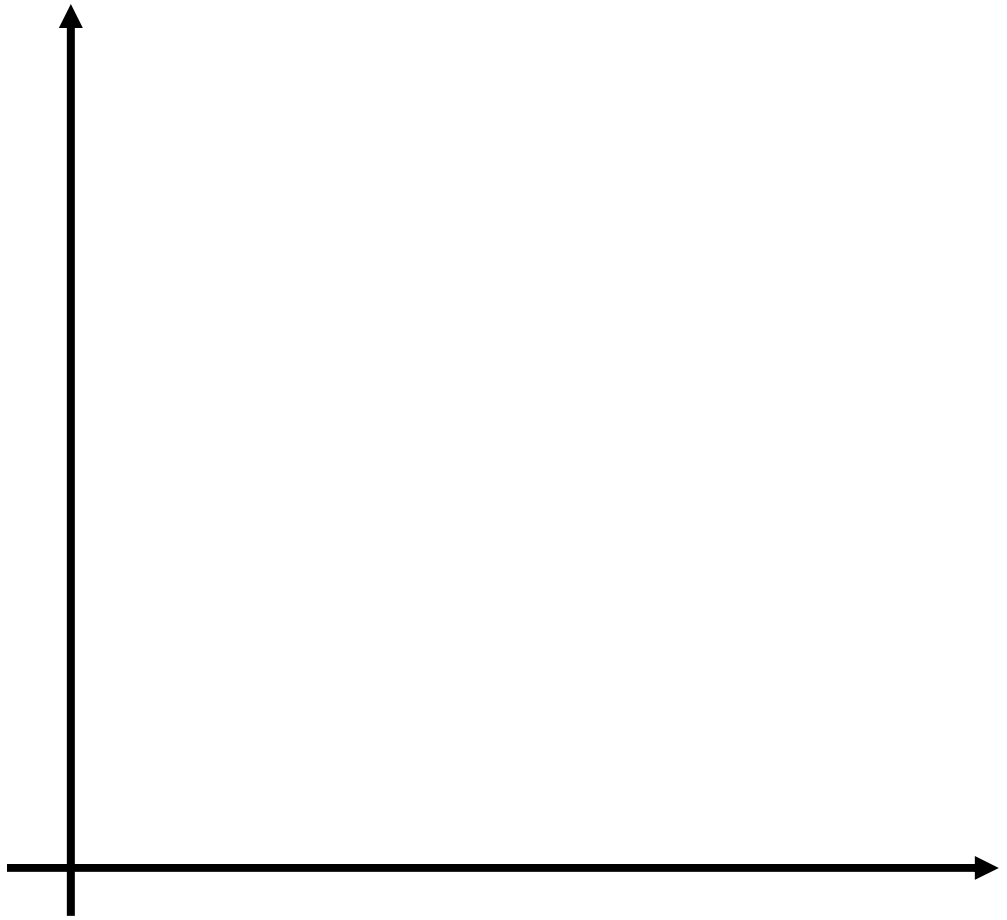
$$\begin{cases} m_c(t) = \frac{v_c(t)}{V_{base}} = M_{DC} + (M_0 - M_{DC})\cos(\theta) + (J_0 - J_{DC})\sin(\theta) \\ j_L(t) = \frac{i_L(t)}{I_{base}} = J_{DC} + (J_0 - J_{DC})\cos(\theta) + (M_{DC} - M_0)\sin(\theta) \end{cases}$$

Normalized Trajectory



State Plane Analysis

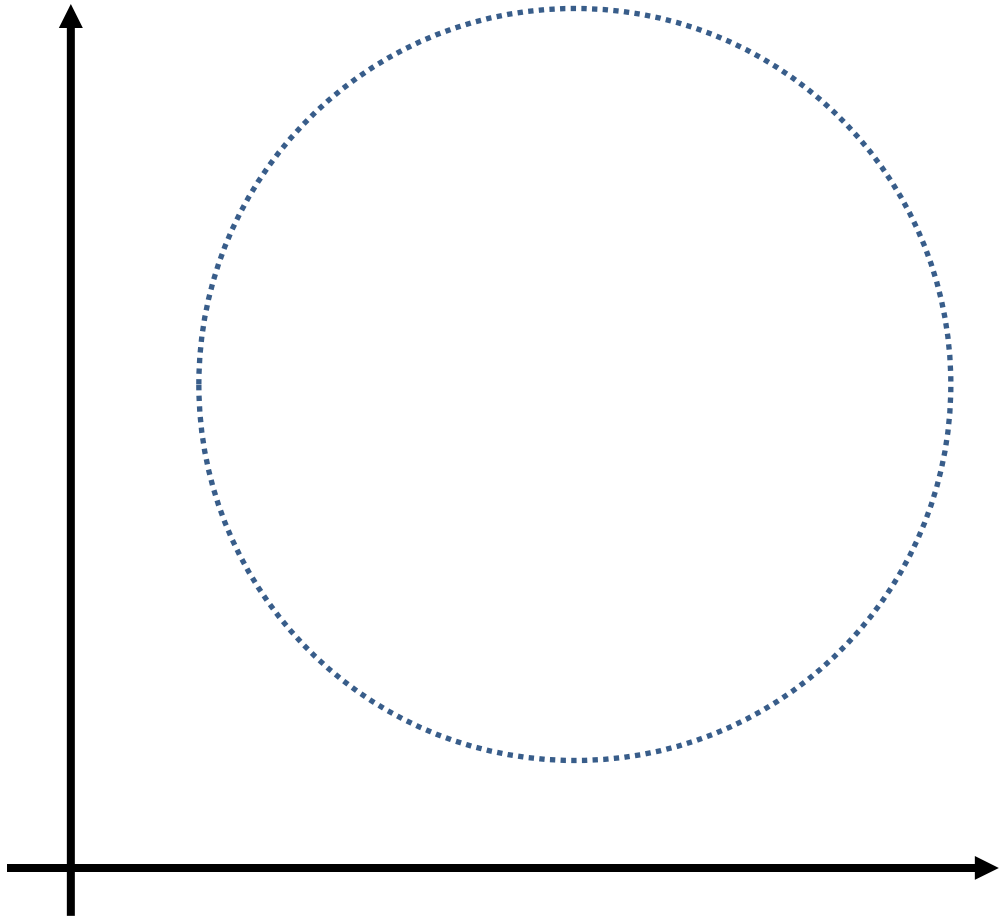




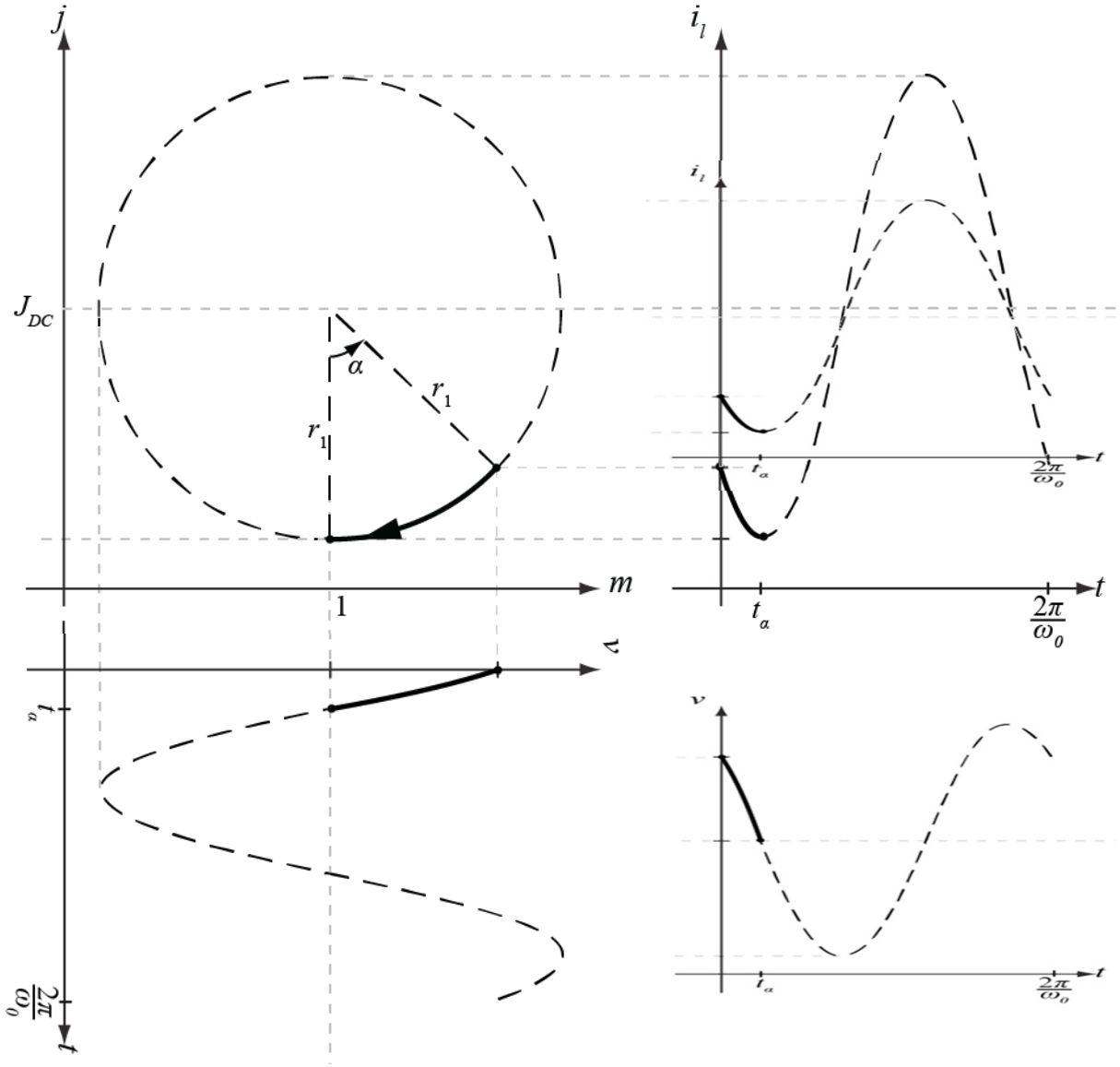
[1] R. Oruganti and F. C. Lee, “Resonant Power Processors, Part I – State Plane Analysis”, Industry Applications, IEEE Tran. on, vol. 21, no. 6, nov 1985.

[2] D. P. Atherton, Nonlinear Control Engineering. London: Van Nostrand Reinhold, 1982, Ch. 2.

Example Analysis



State Plane Algorithm


j
J_{DC}
α
r_1
r_1
m
1
v
t_α
$\frac{2\pi}{\omega_0}$
t
i_l
i_l
t_α
$\frac{2\pi}{\omega_0}$
t
v
t_α
$\frac{2\pi}{\omega_0}$
t

DCM Buck Converter Example (M=1/2)