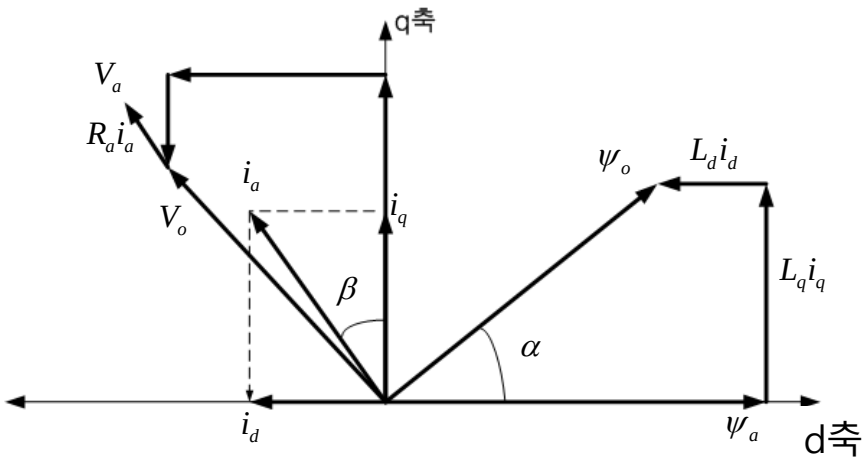
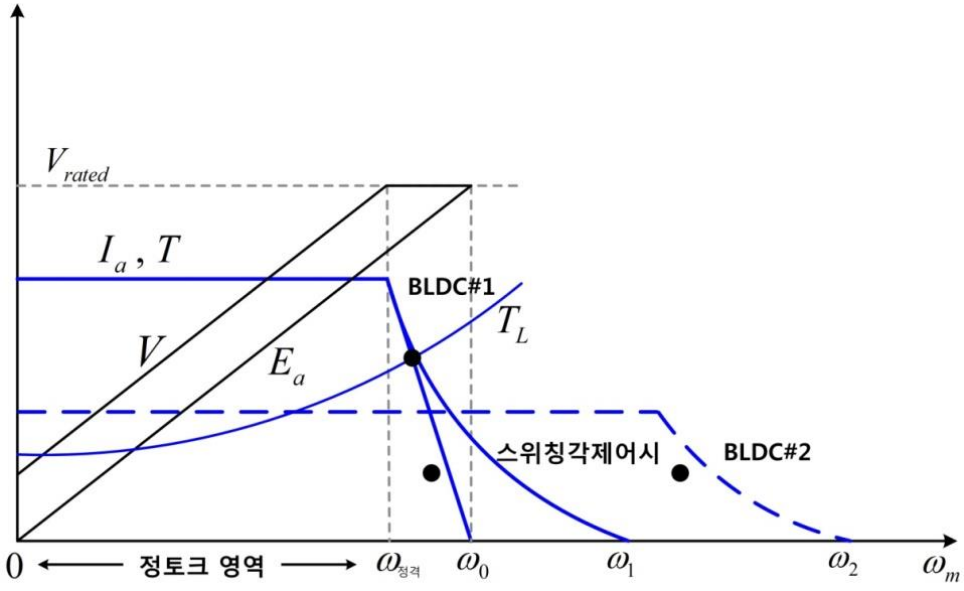
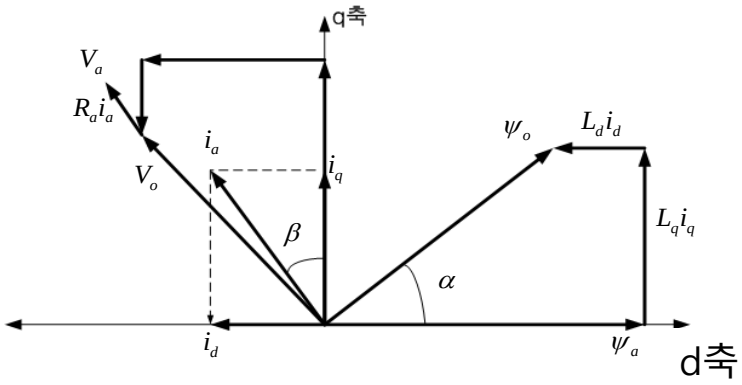
전기기기

BLDC/BLAC


q축
V_a
$R_a i_a$
i_a
V_o
i_q
β
ψ_o
$L_d i_d$
$L_q i_q$
α
i_d
ψ_a
d축


V_{rated}
I_a , T
BLDC#1
T_L
V
E_a
스위칭각제어시
BLDC#2
0
정토크 영역
$\omega_{정격}$
ω_0
ω_1
ω_2
ω_m

전압/전류제한



$$T = \frac{3}{2}\frac{P}{2}\left\{\Psi_a I_a \sin\beta + \frac{1}{2}(L_q - L_d){I_a}^2 \sin 2\beta\right\}$$

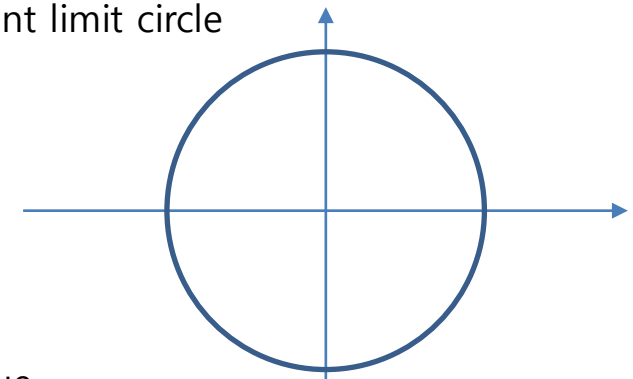
$$\frac{\partial T}{\partial \beta} = \frac{3}{2}\frac{P}{2}\left\{\Psi_a I_a \cos\beta + (L_q - L_d){I_a}^2 \cos 2\beta\right\}=0$$

$$\Psi_a I_a \cos\beta + (L_q - L_d){I_a}^2(2\cos^2\beta - 1) = 0$$

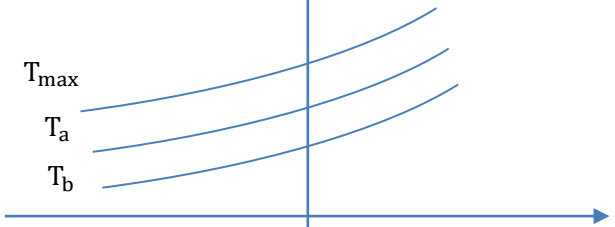
$$\cos\beta = \frac{-\Psi_a + \sqrt{{\Psi_a}^2 + 8(L_q - L_d)^2 {I_a}^2 (L_q - L_d)}}{4 + (L_q - L_d) I_a}$$

$$\beta = \cos^{-1}\left(\frac{-\Psi_a + \sqrt{{\Psi_a}^2 + 8(L_q - L_d)^2 {I_a}^2 (L_q - L_d)}}{4 + (L_q - L_d) I_a}\right)$$

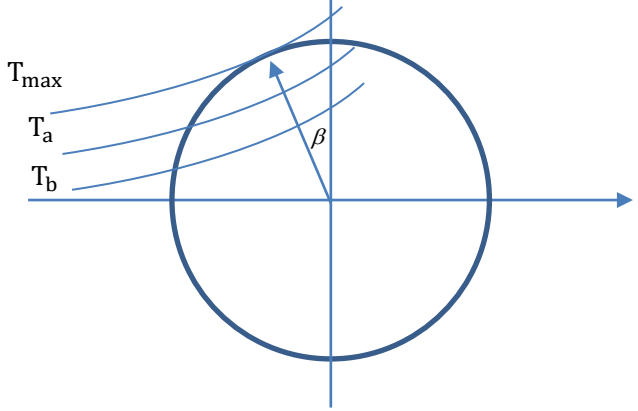
Current limit circle



Torque

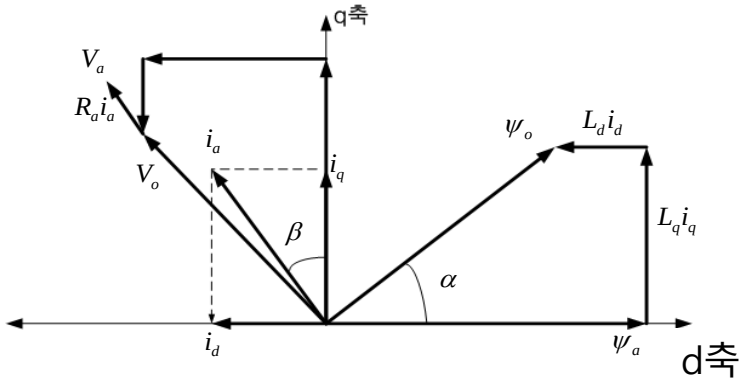


Current limit circle + Torque



전압/전류제한

$$V_a^2 = V_d^2 + V_q^2 \le V_{limit}$$

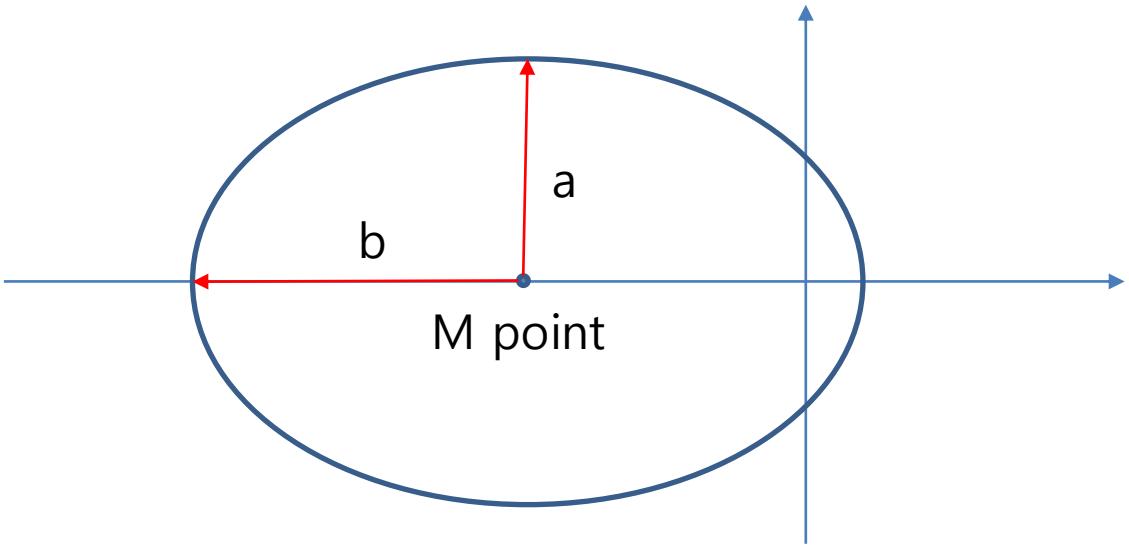


$$V_d = R\,I_d + \frac{d\lambda_d}{dt} - \omega_r L_q\, I_q$$

$$V_q = R\,I_q + \frac{d\lambda_q}{dt} + \omega_r (L_d I_d + \phi_f)$$

$$(\omega_r L_q\, I_q)^2 + (\omega_r (L_d I_d + \phi_f))^2 \le (V_{limit})^2$$

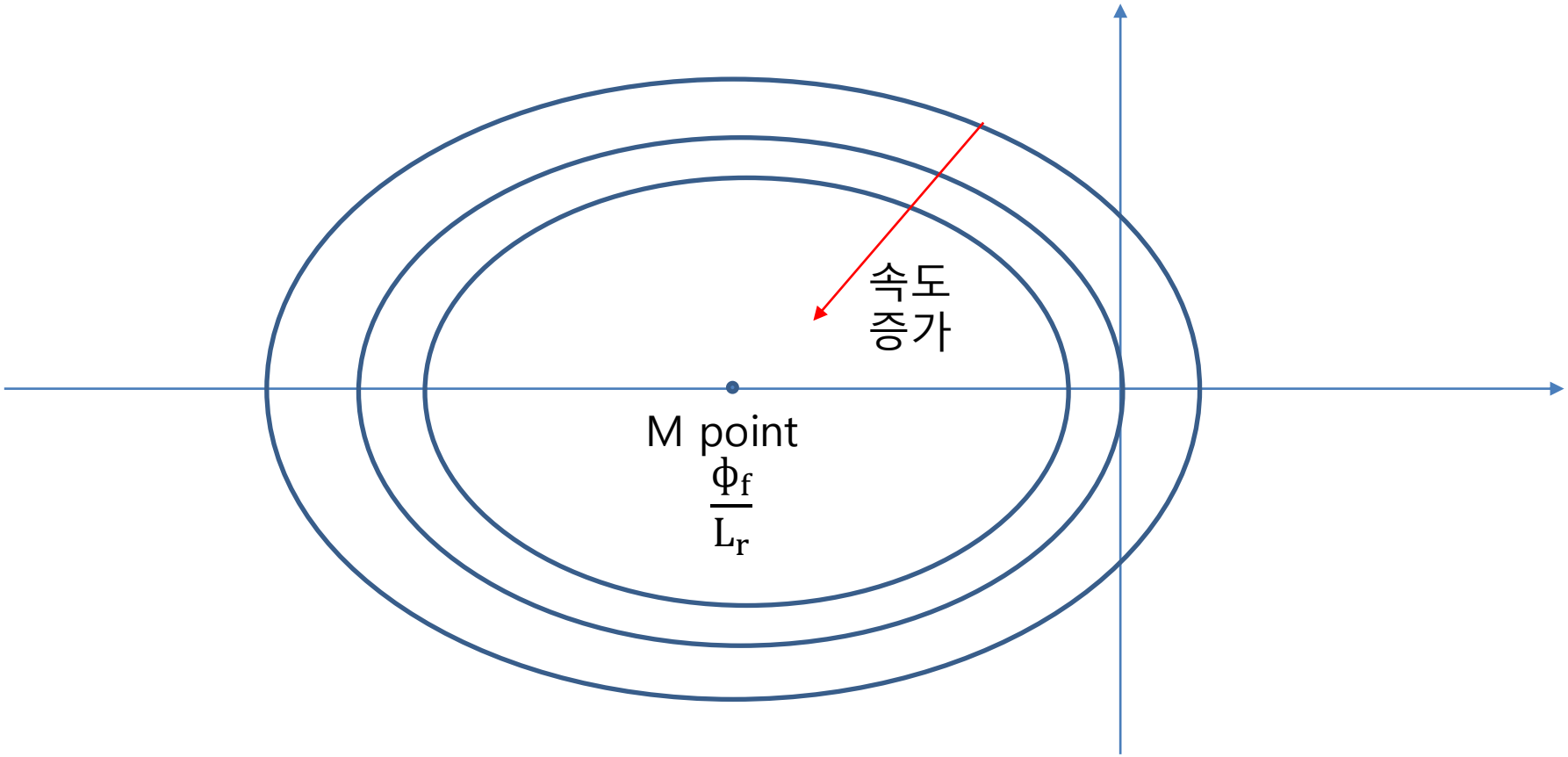
Format of eclipse equation



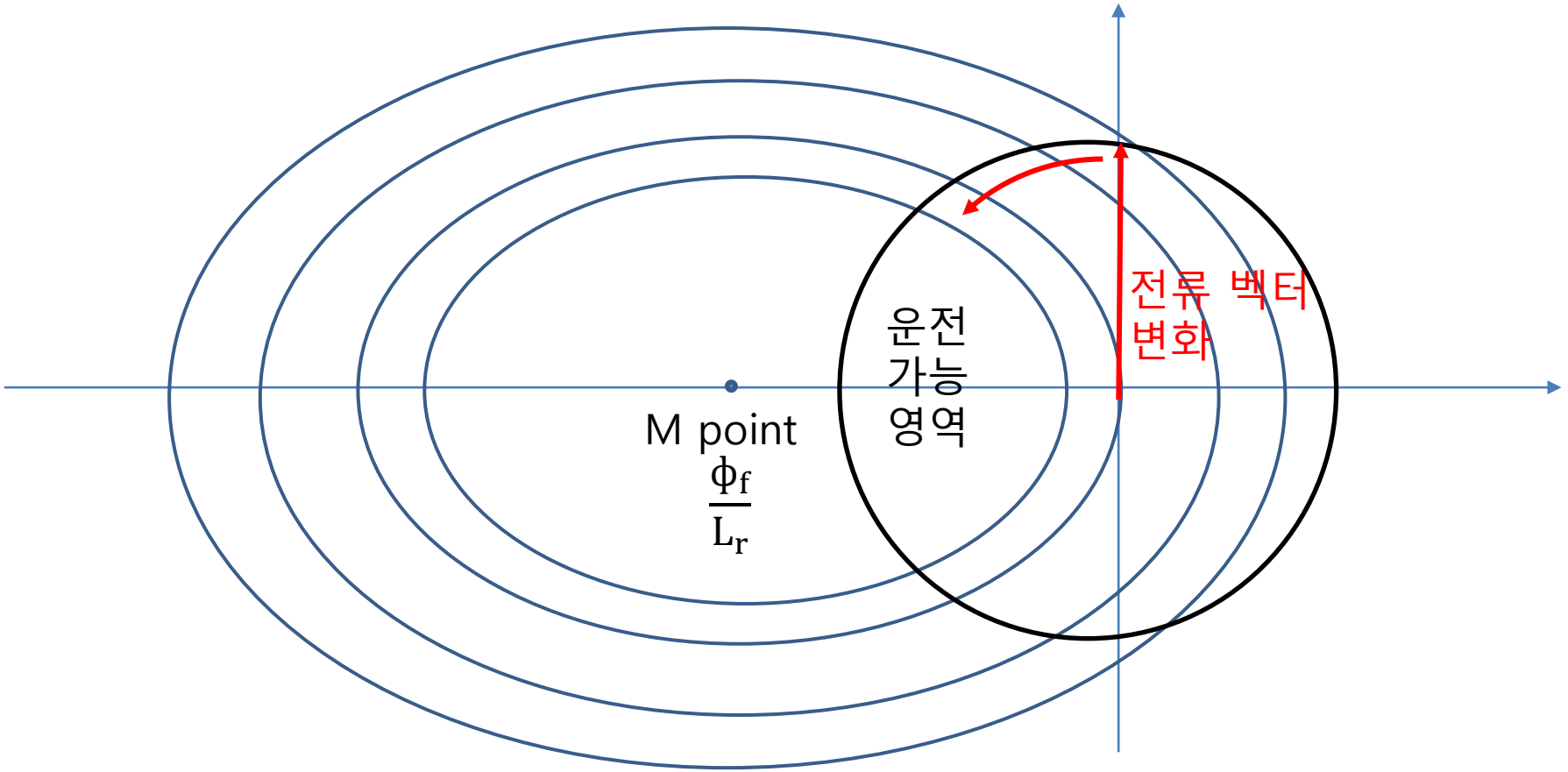
전압/전류제한

$$(\omega_r L_q\ I_q)^2+(\omega_r(L_d I_d+\phi_f))^2 \le (V_{limit})^2$$

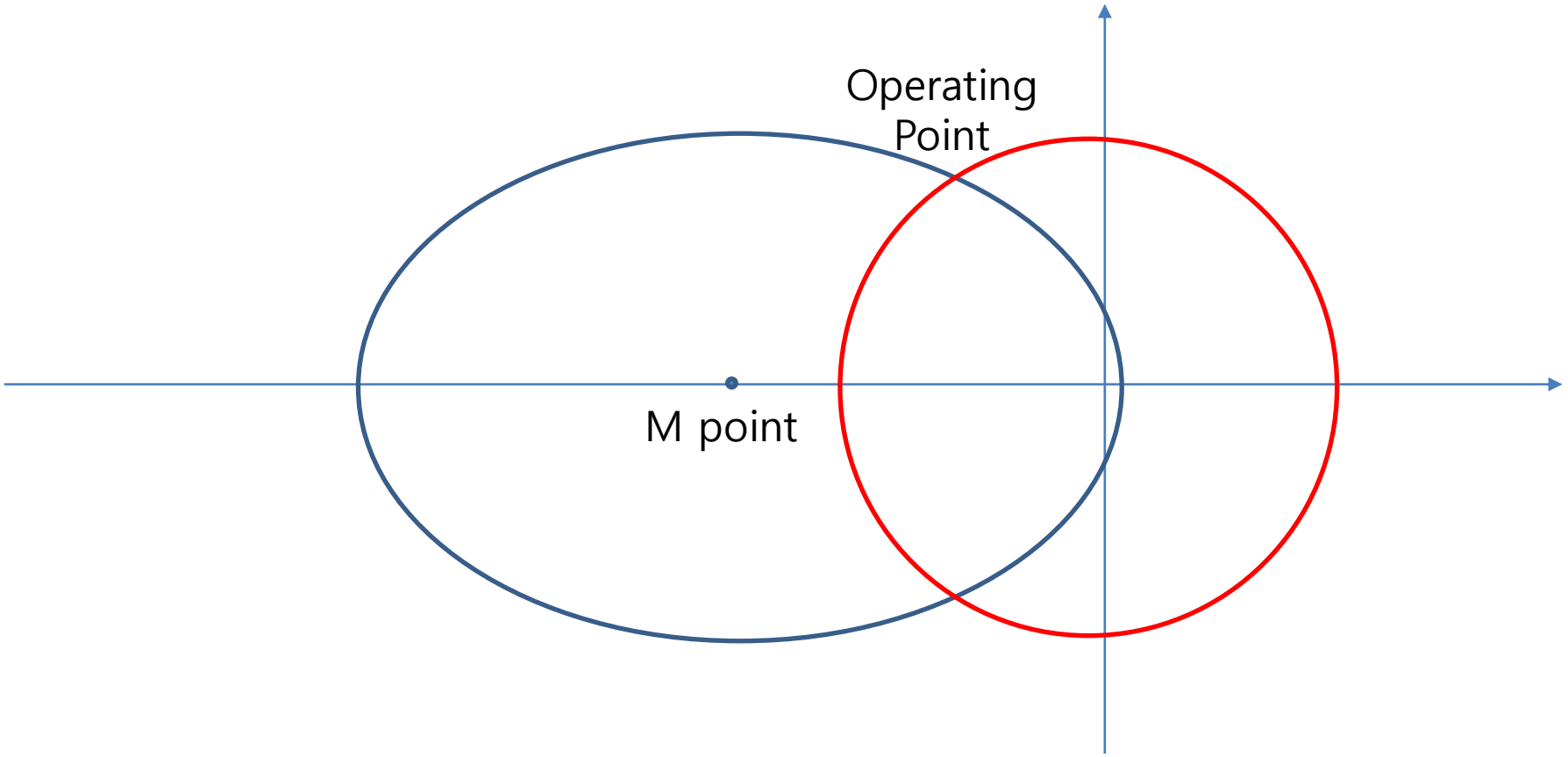
$$(L_q\ I_q)^2+(L_d I_d+\phi_f)^2 \le \left(\frac{V_{limit}}{\omega_r}\right)^2$$



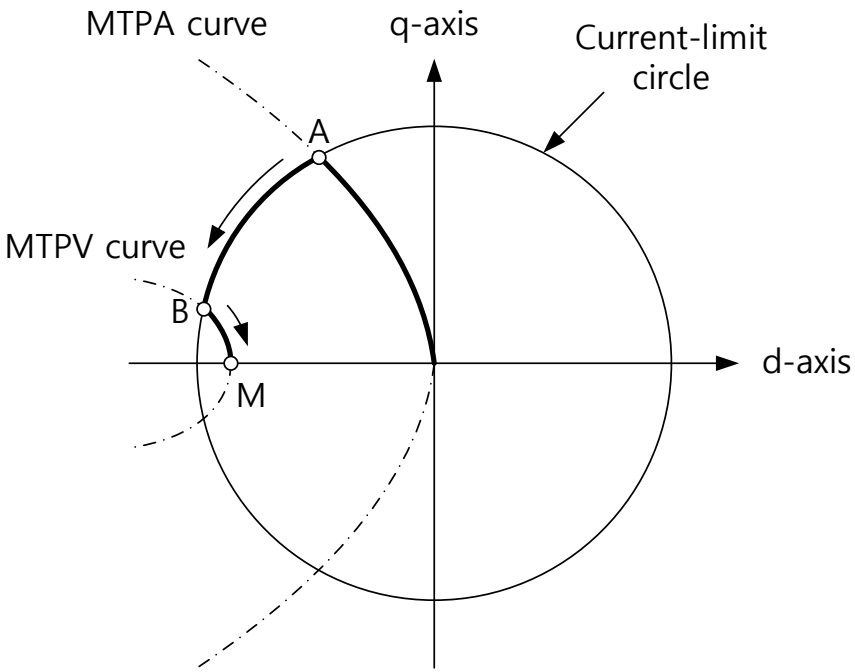
전압/전류제한



전압/전류제한

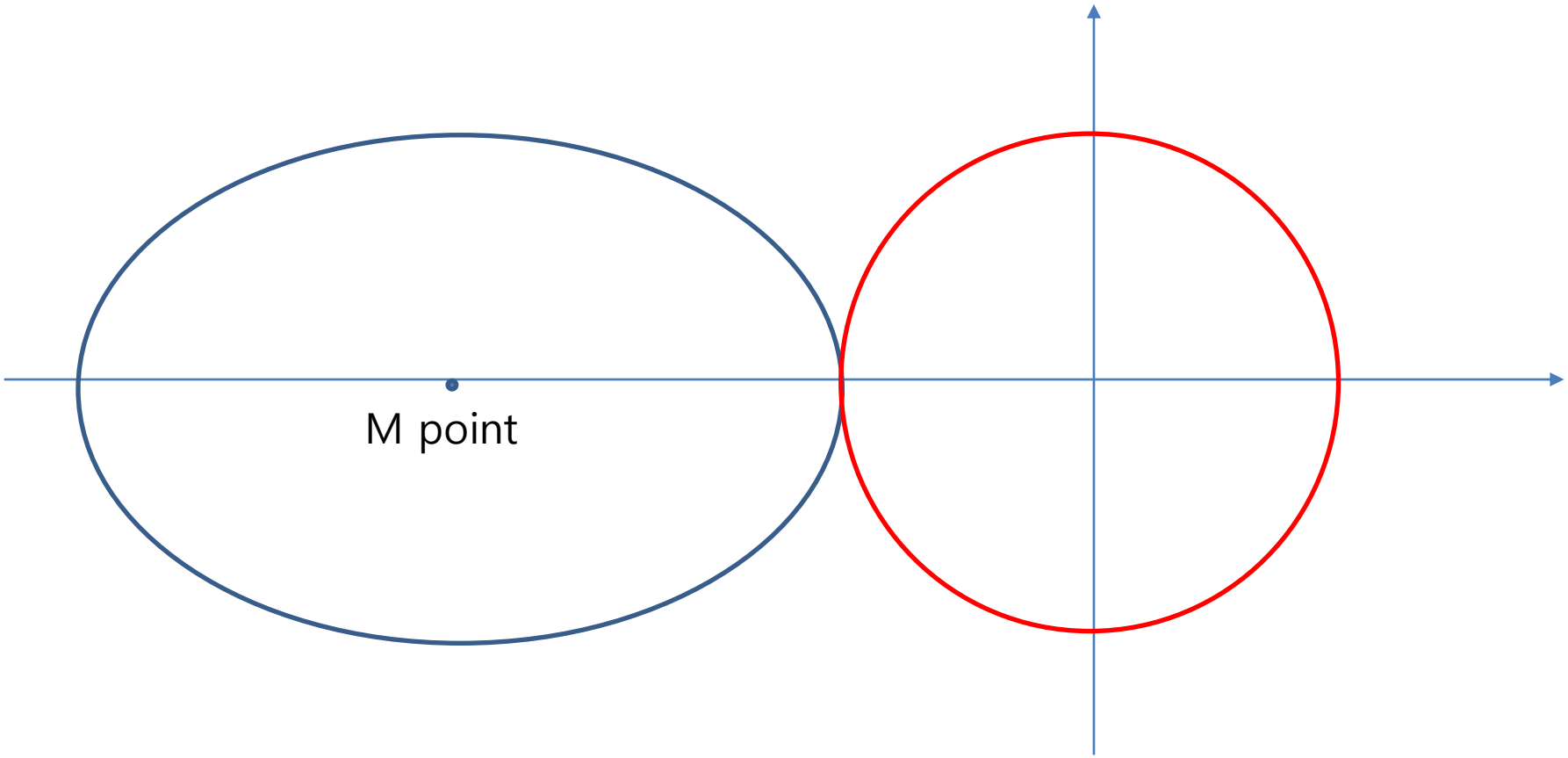


전압/전류제한



전압/전류제한

요구되는 속도보다 낮은 속도에서 다음과 같은 그래프가 그려진다면 어떻게 수정해주어야 하는가?!



Thank you.