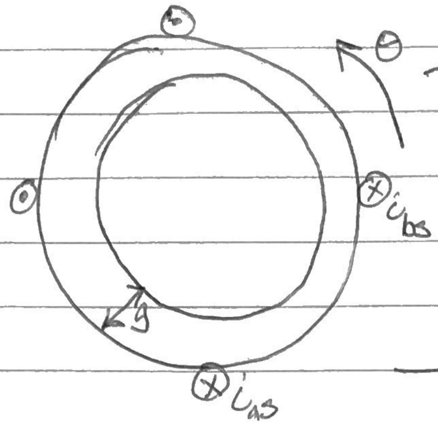
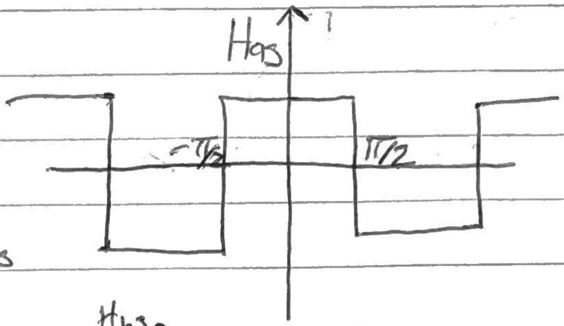
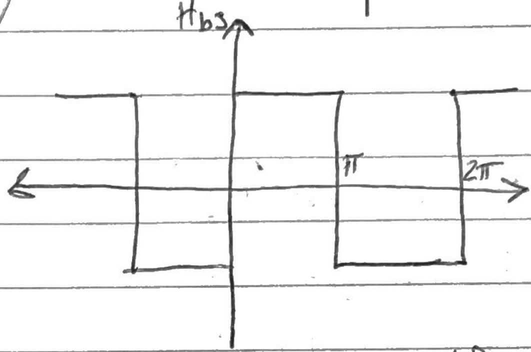
Correction for 2phase

Stator Magnetic field:







$$H_{as} \approx \frac{N_s i_{as}}{2g} \cos(\theta) \qquad H_{bs} \approx \frac{N_s i_{bs}}{2g} \sin(\theta)$$

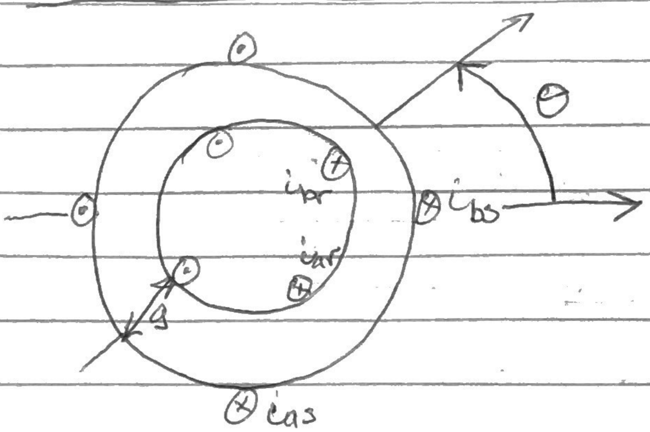
Assume: $i_{as} = I_s \cos(\omega_s t)$ $\qquad$ $i_{bs} = I_s \sin(\omega_s t)$

$$H_s = H_{as} + H_{bs}$$
$$= \frac{N_s I_s}{2g}\left(\cos(\omega_s t)\cos(\theta) + \sin(\omega_s t)\sin(\theta)\right)$$

$$\boxed{H_s = \frac{N_s I_s}{2g} \cos(\omega_s t - \theta)}$$

$t=0$, max H_s at $\theta=0$
$t=\xi$ max H_s at $\theta=\omega\xi$

Two Phase Rotor-Stator



$$\begin{bmatrix} \lambda_{as} \\ \lambda_{bs} \\ \lambda_{ar} \\ \lambda_{br} \end{bmatrix} = \begin{bmatrix} L_s & 0 & M\cos(\theta) & -M\sin(\theta) \\ 0 & L_s & M\sin(\theta) & M\cos(\theta) \\ M\cos(\theta) & M\sin(\theta) & L_r & 0 \\ -M\sin(\theta) & M\cos(\theta) & 0 & L_r \end{bmatrix} \begin{bmatrix} i_{as} \\ i_{bs} \\ i_{ar} \\ i_{br} \end{bmatrix}$$

$$W_m' = \frac{1}{2}\left[L_s(i_{as}^2 + i_{bs}^2) + L_r(i_{ar}^2 + i_{br}^2)\right] + M\cos(\theta) i_{as} i_{ar} + M\sin(\theta) i_{bs} i_{ar}$$
$$- M\sin(\theta) i_{as} i_{br} + M\cos(\theta) i_{bs} i_{br}$$

$$T^e = \frac{\partial W_m'}{\partial \theta} = -M\sin(\theta)\left[i_{as} i_{ar} + i_{bs} i_{br}\right] - M\cos(\theta)\left[i_{as} i_{br} - i_{bs} i_{ar}\right]$$

Assume: $i_{as} = I_s \cos(\omega_s t)$ $\quad$ $i_{ar} = I_r \cos(\omega_r t)$

$i_{bs} = I_s \sin(\omega_s t)$ $\quad$ $i_{br} = I_r \sin(\omega_r t)$

$\theta = \omega_m t + \gamma$

$$\Rightarrow T^e = -M I_s I_r \sin\left(\left[\omega_m - \omega_s + \omega_r\right] t + \gamma\right)$$

Frequency condition: $\omega_m = \omega_s - \omega_r$

* Gives constant torque

$T^e = -M I_s I_r \sin(\gamma)$

$P = -\omega_m M I_s I_r \sin(\gamma)$