$J\ddot{q}+\frac{1}{2}\frac{dJ}{dq}\dot{q}^2=Q$; $J(q)=\sum_{j=2}^{l}\left[m_j\left(u_{G_j}^2+v_{G_j}^2\right)+I_{G_j}h_j^2\right]$; $Q=\sum_i\left(F_i^x u_i+F_i^y v_i\right)+\sum_j M_j h_j$

$n_s=\frac{120f}{p}$; $s=\frac{n_s-n}{n_s}$; $P=\sqrt{3}VI\cos\varphi$; $Q_{cons}=-\frac{dV_{cons}}{dq}$; $\delta U^*=\sum_{k=1}^{n}Q_k^*\delta q_k$

$\dot{\emptyset}_i=g_i\dot{q}$; $g_i'=\frac{dg_i}{dq}=\frac{d^2\emptyset_i}{dq^2}$; $\ddot{\emptyset}_i=g_i\ddot{q}+g_i'\dot{q}^2$; $\dot{x}_P=u_P\dot{q}$; $\dot{y}_P=v_P\dot{q}$; $\ddot{x}_P=u_P\ddot{q}+u_P'\dot{q}^2$

$q^{n+1}=q^n+h\dot{q}^n$; $\dot{q}^{n+1}=\dot{q}^n+h\ddot{q}^n$; $\frac{d}{dt}\left(\frac{\partial L}{\partial\dot{q}_k}\right)-\frac{\partial L}{\partial q_k}=Q_k^*$; $L=T-V$

$\dot{q}_2=\pm\sqrt{\frac{\boldsymbol{J_1\dot{q}_1^2+2\int_{q_1}^{q_2}Qdq}}{\boldsymbol{J_2}}}$; $t_{j+2}-t_j=\frac{\Delta q}{3}\left(\frac{1}{\dot{q}_j}+\frac{4}{\dot{q}_{j+1}}+\frac{1}{\dot{q}_{j+2}}\right)$; $\Delta t=\frac{2\Delta q}{\dot{q}_{j+1}}$

$Y(\theta)=J_0\omega_0^2+2\int_0^{\theta}Q(\theta)d\theta$; $\dot{q}_i=\sqrt{\frac{Y_i}{J_i}}=\sqrt{\tan\gamma_i}$; $\dot{q}_{max}=\sqrt{\tan\gamma_{max}}$; $\dot{q}_{min}=\sqrt{\tan\gamma_{min}}$

Coordinate transform for return motion: $s_{ret}=H-s(\theta-\gamma)$; where, return of H begins at $\theta=\gamma$ and ends at $\theta=\gamma+\beta$

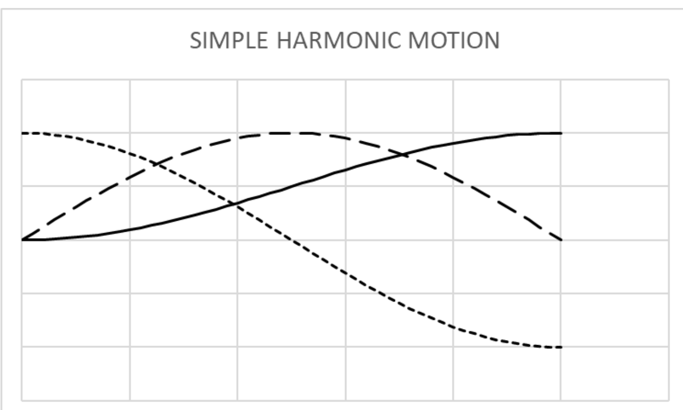
$\dot{s}_{max}=C_v\frac{H}{\beta}\omega$; $\ddot{s}_{max}=C_a\frac{H}{\beta^2}\omega^2$; $\dddot{s}_{max}=C_j\frac{H}{\beta^3}\omega^3$

Disk cam with in-line translating flat-faced follower:

$\rho=r_b+s+s''$; $\rho_{min}\cong r_b+s_{at\,(s'')min}+(s'')_{min}\geq\rho_{all}$

Disk cam with in-line translating roller follower:

$\tan\alpha=\frac{s'}{r_b+r_r+s}$; $\tan\alpha_{max}\cong\frac{(s')_{max}}{r_b+r_r+s_{at\,(s')max}}$



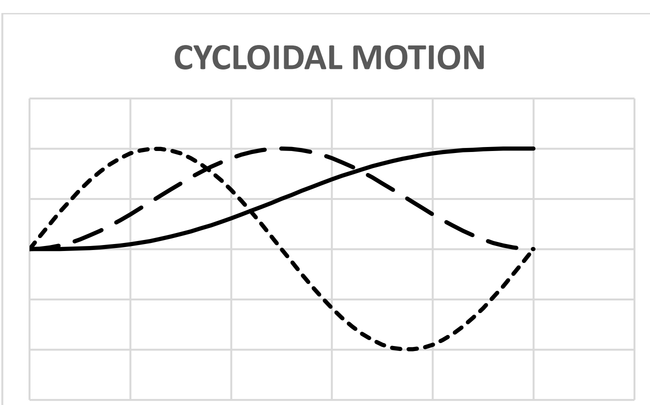
$C_v=\pi/2$

$C_a=\pi^2/2$

$$s=\frac{H}{2}\left(1-\cos\frac{\pi\theta}{\beta}\right)$$

$$s'=\frac{\pi H}{2\beta}\sin\frac{\pi\theta}{\beta}$$

$$s''=\frac{\pi^2 H}{2\beta^2}\cos\frac{\pi\theta}{\beta}$$



$C_v=2$

$C_a=2\pi$

$$s=H\left(\frac{\theta}{\beta}-\frac{1}{2\pi}\sin\frac{2\pi\theta}{\beta}\right)$$

$$s'=\frac{H}{\beta}\left(1-\cos\frac{2\pi\theta}{\beta}\right)$$

$$s''=\frac{2\pi H}{\beta^2}\sin\frac{2\pi\theta}{\beta}$$