Quasi Co-ordinates :-

In many dynamical problems, it is difficult to find velocity of particle when co-ordinates occurs as a lagranges co-ordinates with generalized velocities.

Let $\omega_1, \omega_2, \ldots, \omega_n$ be independent co-ordinates in terms of velocities $\dot{q}_1, \dot{q}_2, \ldots, \dot{q}_n$ is given by

$$\omega_s = a_{sk}\dot{q}_k \quad \text{---(1)}$$

$$s, k = 1, 2, \ldots, n$$

where a_{sk} is a matrix which is a fun. of q's only.

$$\omega_1 = q_{11}\dot{q}_1 + q_{12}\dot{q}_2 + q_{13}\dot{q}_3 + \cdots + q_{1k}\dot{q}_k$$

$$\omega_2 = q_{21}\dot{q}_1 + q_{22}\dot{q}_2 + q_{23}\dot{q}_3 + \cdots + q_{2k}\dot{q}_k$$

$$\vdots$$

$$\omega_s = q_{s1}\dot{q}_1 + q_{s2}\dot{q}_2 + q_{s3}\dot{q}_3 + \cdots + q_{sk}\dot{q}_k$$

so

$$\omega_s = \begin{bmatrix} q_{s1} & q_{s2} & q_{s3} & \cdots & q_{sk} \end{bmatrix} \begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \\ \vdots \\ \dot{q}_k \end{bmatrix}$$

$$\omega_s = a_{sk}\dot{q}_k$$

we define Quasi co-ordinates by $\pi_1, \pi_2, \pi_3, \ldots, \pi_n$.

$$\lambda_s = \int_0^t \omega_s \, dt = \int_0^t a_{sk} \, \dot{q}_k \, dt$$

$$\dot{\lambda}_s = a_{sk} \, \dot{q}_k$$

so

$$d\lambda_s = a_{sk} \, dq_k \qquad (1)$$

$$\omega_s = a_{sk} \, \dot{q}_k$$

$$\dot{q}_k = b_{ks} \, \omega_s \qquad \text{where } b_{ks} = (a_{sk})^{-1}$$

eq (1) becomes

$$dq_k = b_{ks} \, d\lambda_s$$

where b_{ks} is the inverse of matrix