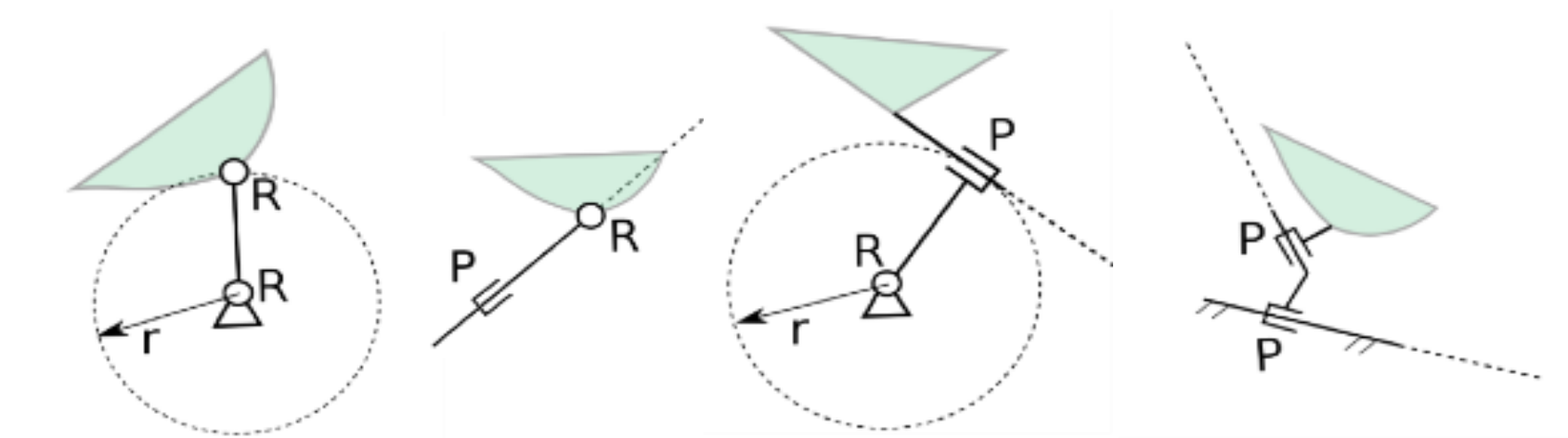


# Review: Unified Representation of Dyad Constraints

- A unified treatment of the **geometric constraints of the building blocks** (dyads for four-bar) of mechanisms



- Homogeneous Representation of Line and Circle

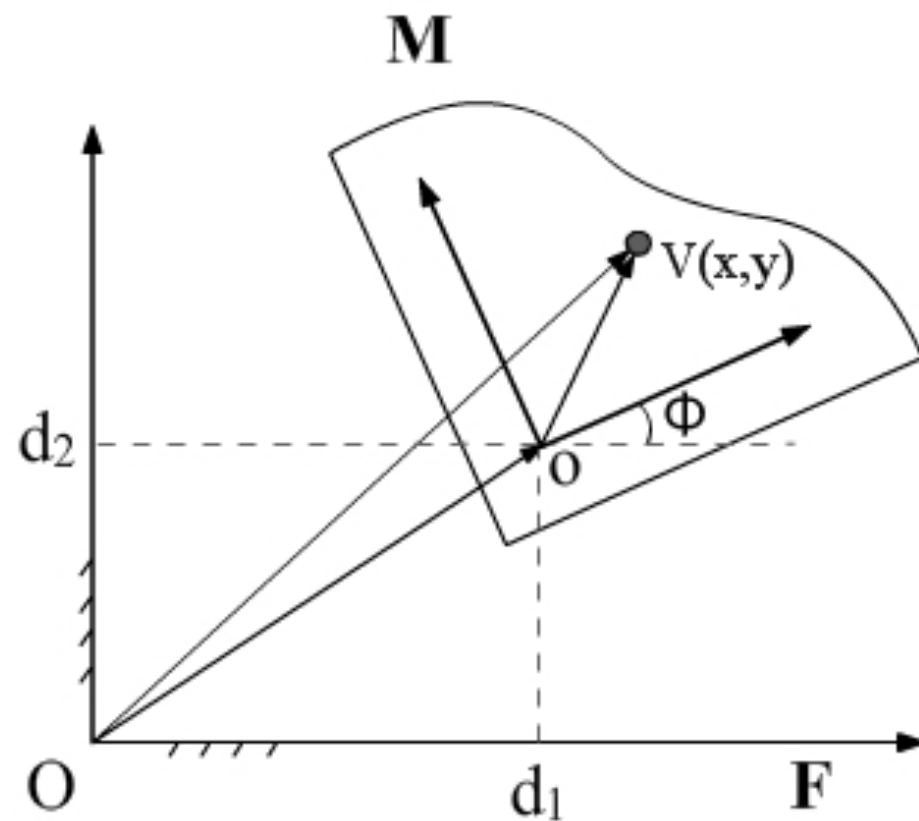
$$2a_1X_1 + 2a_2X_2 + a_3X_3 = a_0\left(\frac{X_1^2 + X_2^2}{X_3}\right)$$

when  $a_0 = 0$

$$L_1X_1 + L_2X_2 + L_3X_3 = 0,$$

# Review: Image Space Approach

## Planar-Quaternions and -Kinematic Mapping



$$Z_1 = \frac{1}{2} \left( d_1 \sin \frac{\phi}{2} - d_2 \cos \frac{\phi}{2} \right),$$

$$Z_2 = \frac{1}{2} \left( d_1 \cos \frac{\phi}{2} + d_2 \sin \frac{\phi}{2} \right),$$

$$Z_3 = \sin \frac{\phi}{2},$$

$$Z_4 = \cos \frac{\phi}{2},$$

$$\begin{bmatrix} X \\ Y \\ 1 \end{bmatrix} = \begin{bmatrix} \cos \phi & -\sin \phi & d_1 \\ \sin \phi & \cos \phi & d_2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \quad X = [H]_x \quad L = [\overline{H}]l$$