Q1.

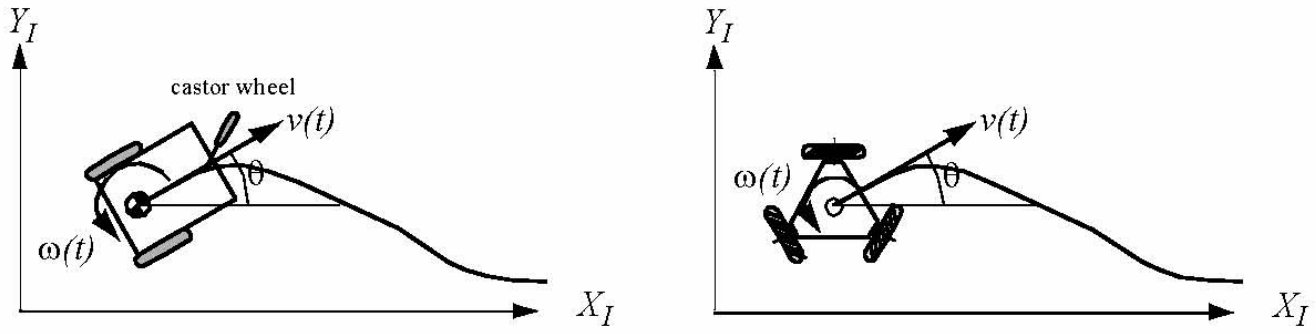


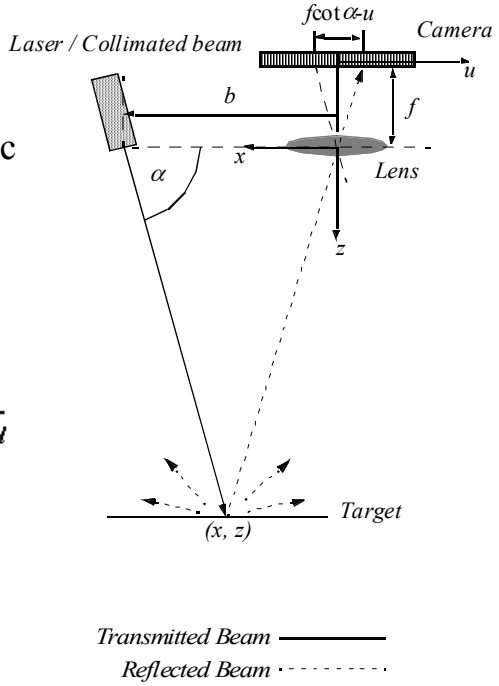
Fig 2.1 Typical configuration of a differential-drive and omni-drive robot

A differential drive robot is moving in the plane by controlling the rotational speed of the two fixed standard wheels. The wheel diameter is given by r and the distance between the origin of the robot and the wheels is l. The the center of rotation of the castor wheel is at a distance l_c with an offset d of the wheel contact point and a wheel of the diameter r_c. The wheels of the omni-drive are arranged symmetrically. The small wheels of the omni-drive are arranged at 90°.

1. Establish the kinematics of the two robots: $\begin{bmatrix} \dot{x} & \dot{y} & \dot{\theta} \end{bmatrix}^T = f(\dot{\varphi}_1, \dot{\varphi}_1, \dot{\varphi}_2, l, r, l_c, d, r_c ...)$

Q2.

Derive the formula x and z using geometrical property.



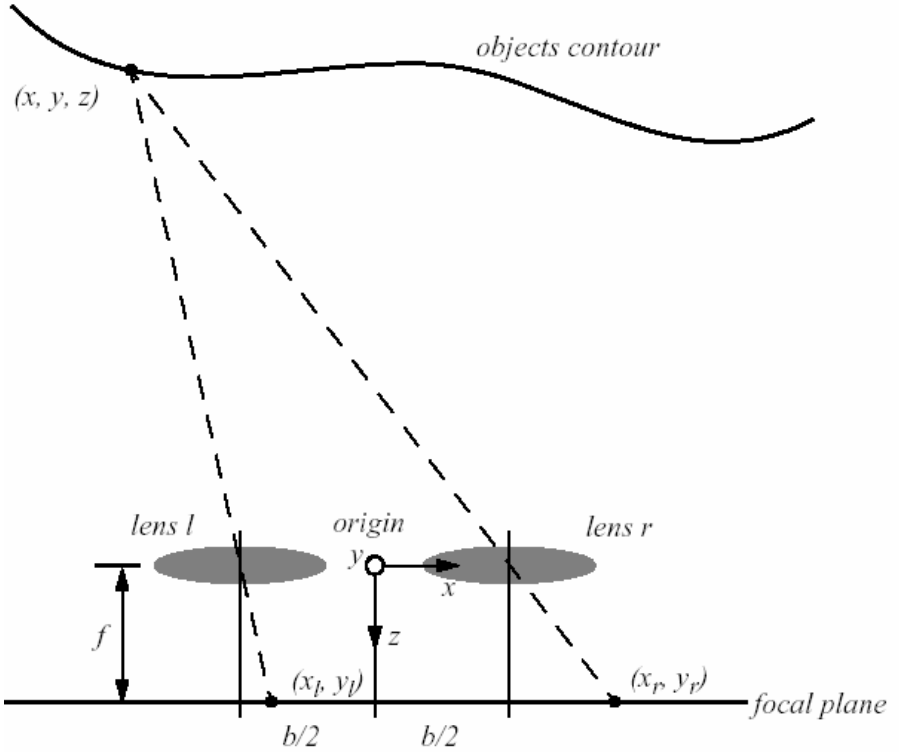
- One dimensional schematic of the principle

- From the figure, simple

$$x = \frac{b \cdot u}{f\cot\alpha - u} \; , \quad z = \frac{b \cdot f}{f\cot\alpha - u}$$

Q3.

Idealize camera geometry for stereo vision using disparity between two images for computing of depth



Q4.

a) Why Canny edge extraction method over perform other methods?

b) Describe Hough Transform to extract straight edges.