# Project 2: Kinematic model of a differential drive mobile robot

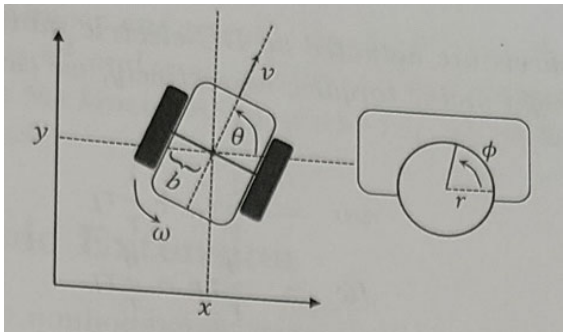


*Figure from [1]*

The basic kinematic model of the differential drive robot (DDR) is according to the following:

$$\dot{x} = \cos(\theta)\, v$$

$$\dot{y} = \sin(\theta)\, v$$

$$\dot{\theta} = \omega$$

$$\dot{v} = \frac{r}{2}\left(\ddot{\phi}_R + \ddot{\phi}_L\right)$$

$$\dot{\omega} = \frac{r}{2b}\left(\ddot{\phi}_R - \ddot{\phi}_L\right)$$

where $x$ and y are the horizontal and vertical positions of the center of the robot, $\theta$ is the angular position (heading) of the robot, $v$ is the forward velocity, $\omega$ is the angular velocity of the robot, $r$ is the radius of the wheel, $b$ is the distance of each wheel to the center of the robot, and $\ddot{\phi}_L$ and $\ddot{\phi}_R$ are the angular accelerations of the left and right wheels. Simulate the planar motion of the robot and analyze pure linear and angular motions and the combinations of both. In this model $\ddot{\phi}_L$ and $\ddot{\phi}_R$ are the system inputs. Use $r = 0.02$ m and $b = 0.05$ m in your simulations.

References:

[1] Spong MW, Hutchinson S, Vidyasagar M. Robot modeling and control. John Wiley & Sons; 2020 Mar 30.