PID:17 3rd May, 2020

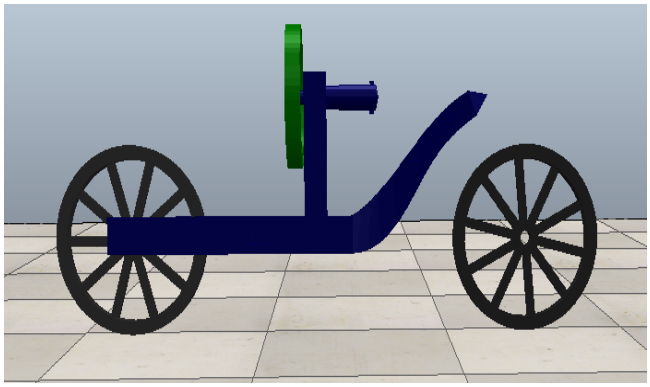
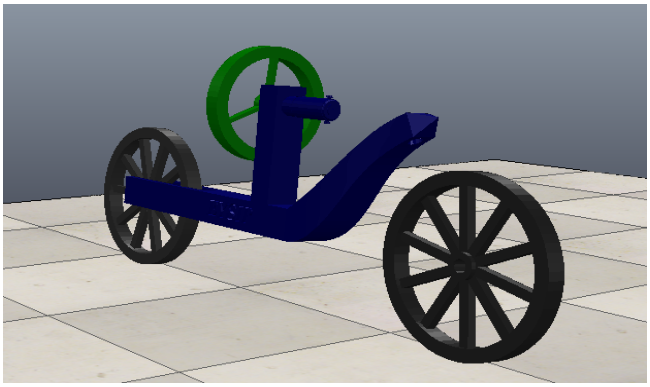
# Kinetic and Potential energy of a system

## 1 Aim

To find out the Kinetic energy and Potential energy of a system. Using these two quantities, find out the Lagrangian of the system and the Euler Lagrange equation.

## 2 Problem

Consider the system of a Cyclebot. A Cyclebot is a robot having two wheels and balanced by the help of a reaction wheel. It resembles a self balancing bot system. For this system, find out the Kinetic energy,the Potential energy and then subsequently go on to find it's Lagrangian and the Euler Lagrange equation.

List of symbols:

- $m_1$ : mass of pendulum
- $L_1$ : Distance between pivot and COM of pendulum
- $I_1$ : Moment of inertia of pendulum about it's COM
- $m_2$ : mass of reaction wheel
- $L_2$ : Distance between pivot and COM of reaction wheel
- $I_2$ : Moment of inertia of reaction wheel about it's COM
- $\theta, \dot{\theta}$: Tilt angle and angular velocity of bicycle
- $\phi, \dot{\phi}$: Angular position and angular velocity of reaction wheel
- $T_r$ : Torque provided to the reaction wheel