Consider a differential drive mobile robot as shown in the figure below. Both wheels have radius $r$. Both wheels can be driven independently. The distance between the two wheels is $L$. Please write a short article (5~6 pages) which includes at least the following information:

- The derivation of the kinematics model of the mobile robot:
  Please include all the details. For example, what are the assumptions for the kinematics model? What is the constraint for the kinematics model? What are the coordinate systems?

- The development of a motion control algorithm for path tracking. For example, you can use the virtual vehicle approach

- The simulation results for your algorithms with discussions:
  Please include the simulation results for at least two paths: a circle and a sinusoidal wave. Please vary your parameters and compare your results.

The format of the short article shall follow the IEEE paper standard as follows:

Title
Author with affiliation

Abstract

I. Introduction
II. Kinematics Model
III. Path Tracking Control
IV. Simulation and Discussion
V. Conclusion
Reference