

## ABSTRACT

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We consider perhaps the simplest unicycle model, motivated by the previous work of Schoonwinkel. His unicycle model consisted of a wheel, a frame, and a turntable, and torques applied at the wheel and turntable were considered to be the control inputs. In the present thesis, we have studied the dynamics of a unicycle by simplifying the equations in one important way. Instead of considering the two driving torques to be control inputs, we have considered the wheel rotation relative to the frame and the turntable rotation relative to the frame, i.e., two angles, to be control inputs. We acknowledge that discontinuous changes to the angles are physically impossible, and that discontinuous changes to the rates of change of these angles require angular impulses. However, provided the finally computed controlled inputs are sufficiently smooth, there is no problem. The system then retains only three degrees of freedom. Furthermore, upon reasonable simplification based on small-angle assumptions, the equations are analytically quite simple to look at.

Subsequently, we present numerical simulations, some elementary linear control calculations, and 3D graphic animations which help visualize the motions resulting from these control inputs. A link to the video showing these animations is included.