Mechanical Engineering Thesis Defense

Trajectory Modeling, Estimation and Interception of a Thrown Ball using a Robotic Ground Vehicle

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abstract

Toward the ambitious long-term goal of developing a Robotic circus, this thesis addresses key steps toward the development of a ground robot that can catch a ball. Toward this end, we examine nonlinear quadratic drag trajectories for a tossed ball. Relevant least square error fits are provided. It is also shown how a Kalman filter and Extended Kalman filter can be used to generate estimates for the ball trajectory. Several simple ball intercept policies are examined. This includes open loop and closed loop policies. It is also shown how a low-cost differential-drive research grade robot can be built, modeled and controlled. Directions for developing more complex x-y planar intercept policies are also briefly discussed. In short, the thesis establishes a foundation for future work on developing a practical ball catching robot.

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