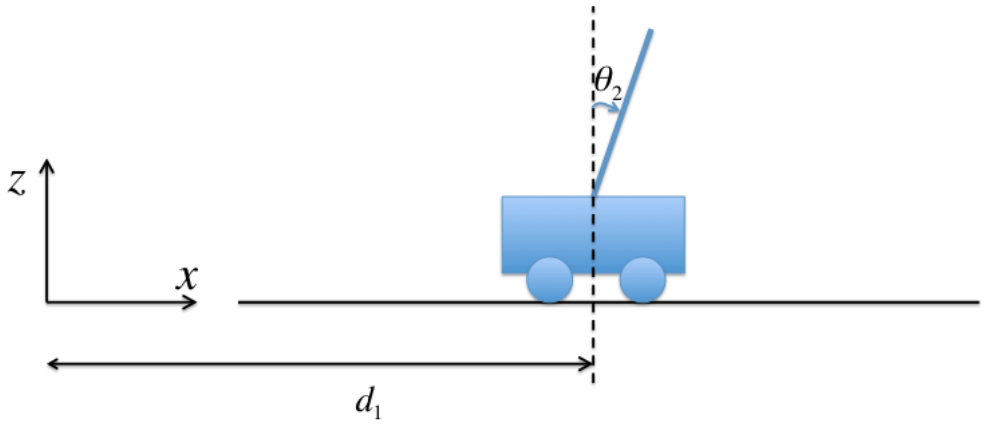
Homework 8

1. (Problem 5.20 from textbook) We desire a joint space trajectory $\dot{q}_i^d(t)$ for the i^{th} joint (assumed to be revolute) that begins at rest at position q_0 at time t_0 and reaches position q_1 in 2 seconds with a final velocity of 1 radian/sec. Compute an LSPB (linear segments with parabolic blends) trajectory to satisfy these requirements. Sketch the position, velocity, and acceleration profiles.

2. (Problem 5.22 from textbook) Write a Matlab m-file, lspb.m to generate an LSPB trajectory, given appropriate initial data.

3. Consider the "cart-pole" (or "cart-pendulum") system shown below. This system has a cart (that can move along one direction, the X-axis), which has a pole attached to it through a revolute joint. Write the dynamics of this system using the Euler-Lagrange equations. Use $q = [d_1, \theta_2]^T$.



Let the mass of the cart be m_1 and the mass of the pole be m_2. Let the constant distance from the revolute joint to the center of mass of the pole be l_2. Let the moment of inertia of the pole (for rotation around the Y-axis) be I_2. Consider gravity as pointing downwards (along negative Z direction).

4. (Problem 7.3 from textbook) Find the 3×3 inertia matrix (i.e., moments of inertia and cross products of inertia) of a uniform rectangular solid of sides a, b, c with respect to a coordinate system with origin at one corner and axes along the edges of the solid.