Precept 2

Agenda

- Ballistics example
- Inverse of matrix w/ LU
- More plotting

Logistics

- HW1 out, due Friday Feb 4 at 9pm
- HW2 out Thursday, due Friday Feb 11 at 9pm

Other

- "How much work should I show?"
- Git

Ballistics Example

Overview

- a projectile moving in 2-dim space
- sample position and velocity at times $t = 0, h, 2h, \ldots$
- $p_t \in \mathbb{R}^2$ is the position at time $t = th$
- $v_t \in \mathbb{R}^2$ is the velocity at time $t = th$
- $f_t \in \mathbb{R}^2$ is the total force on projectile at time $t = th$
- $x_t = \begin{pmatrix} p_t \\ v_t \end{pmatrix}$ is the projectile state at time $t = th$

Force model

- $f_t = mg - \eta v_t$
  - $\eta \in \mathbb{R}$ is the drag coefficient
  - $g = \begin{pmatrix} 0 \\ -9.8 \end{pmatrix}$ is gravity

Dynamics

- approximate velocity as constant over time interval $th \leq t \leq (t+1)h$

- approximating force as constant over the time interval

Now write this more compactly as $x_{t+1} = Ax_t + b$

Propagating the state through time

Targeting Problem

Given

- initial position P_0
- parameters h, m, η
- flighttime Th
- desired final position (target) P_T

Goal

- find the initial velocity

Final State

Robust ballistics

- Suppose we have uncertainty in the drag coefficient
- uncertainty modeled as K scenarios
  - each scenario has its own
    - $A^{(j)}, b^{(j)}$
    - $C^{(j)}, d^{(j)}$

Robust targetting