Solvo.ai Coding Test

The purpose of this coding test is to evaluate your coding ability, but also to understand your approach to production code, maintainability and collaboration on a shared code base.

Task Description

Consider a particle of unit mass, located on a one-dimensional line. The goal of the particle is to remain at its starting point, in the presence of a variable force e_t acting along the line. The task is to specify, at each discrete time step, the appropriate force u_t to apply to the particle such that it stays as close as possible to the starting point. The particle will start stationary, and should move for 1000 time steps.

Concretely, the particle is a point on the line, starting at the origin. The disruptive force acts along the line, and the controlling force also acts along the line. The position of the particle will be denoted x, and the starting point will be at $x = 0$. The particle starts at rest. The dynamics are as follows:

- The total force applied to the particle at each time step is $F_t = e_t + u_t$
- The particle acceleration at each time step is $a_t = e_t + u_t$
- The change in particle velocity at each time step is $\Delta v_t = a_t * \Delta t$
- The change in particle position at each time step is $\Delta x_t = v_t * \Delta t - \frac{1}{2} a_t * \Delta t^2$

The evaluation metric for this system (the reward, or cost function), is defined as the absolute distance between the particle and the starting point: x. This metric is measured at each time step, and should be minimised overall.

A reference implementation of the particle dynamics will be provided to you. It is not necessary to use the reference implementation in your solution.

Your Solution

Your solution should be a command line application which runs your control algorithm and the particle dynamics and outputs the reward (or cost). The control algorithm should minimise the cumulative reward overall. The following characteristics of your solution will be considered:

- Code structure and overall design
- Documentation
- Tests
- Additional runtime evaluation metrics, where appropriate
- Overall cumulative cost
- Runtime performance

Please note that this system has an analytical, optimal control strategy. It is not necessary to produce that strategy, and we encourage you to use an approach which can best illustrate your abilities. If you have any questions about the content of this test please contact hiring@solvo.ai.