MATLAB Portion

This section of the homework details the code and results for the last problem. The relevant code and results are shown below.

Results

The following plot shows the optimal input for the given fuel curve and desired end state.

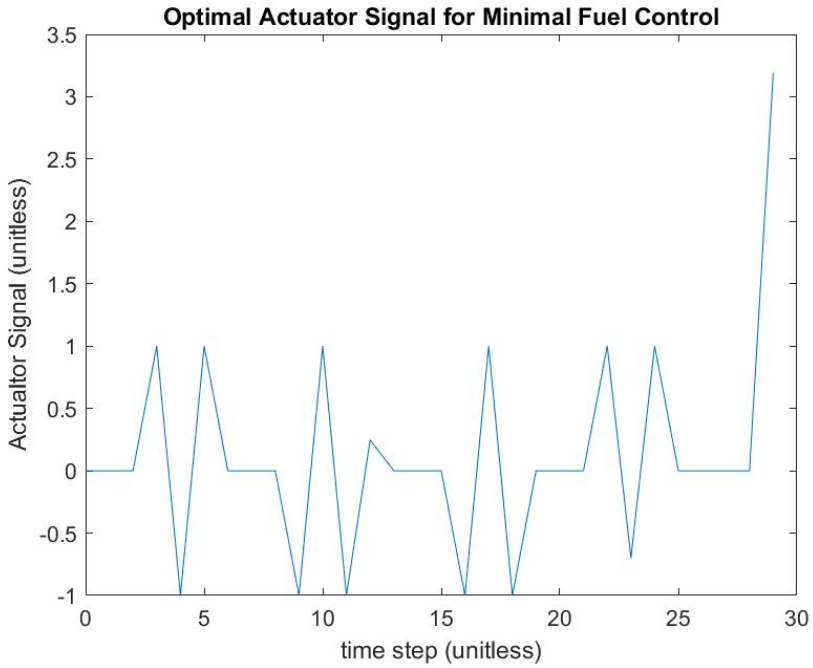

Figure 1: Optimal Input

As we can see the optimal input remains largely on the set $[-1, 1]$. This makes sense as the fuel curve has a higher cost for larger inputs, as a result this passes a quick sanity check.

Code

The following code block provides the script used to generate the optimal input.

```
%%
 %  File: Homework_3.m
```

```
%
%  Author: Thomas Kost
%
%  Date: 25 January 2022
%
%  @brief homework 3 matlab problem concerning optimal fuel control
%
clear all, clc, close all;

% Problem Data
A = [-1, 0.4, 0.8;
      1,   0,   0;
      0,   1,   0];
b = [1; 0; 0.3];
x_des = [7; 2; -6];
N = 30;
x_0 = [0;0;0];
prop = zeros(3,N);
for i = 1:N
    prop(:,i) = (A^(i-1))*b;
end
    prop = fliplr(prop);
% Perform optimization
cvx_begin
    variable u(N)
    minimize(sum(max(abs(u),2*abs(u)-1)))
    subject to
        prop*u == x_des
cvx_end
input = figure()
plot([0:N-1],u);
xlabel("time step (unitless)");
ylabel("Actualtor Signal (unitless)");
title("Optimal Actuator Signal for Minimal Fuel Control");
saveas(input, "optimal_input.jpg");
```