## Contents



```
%Tyler Matthews
%System Simulation Final
%P3
clear all; clc; close all;

startTime = 0;
stopTime = 100;
T = 1;

N = stopTime/T;
t = linspace(startTime,stopTime,stopTime/T);



alpha_1 = 0.1;
alpha_2 = 0.3;
fx1 = zeros(1,N);
fx2 = zeros(1,N);
x1 = zeros(1,N); % Feelings Belle has for the Beast
x2 = zeros(1,N); % Feelings the Beast has for Belle
```

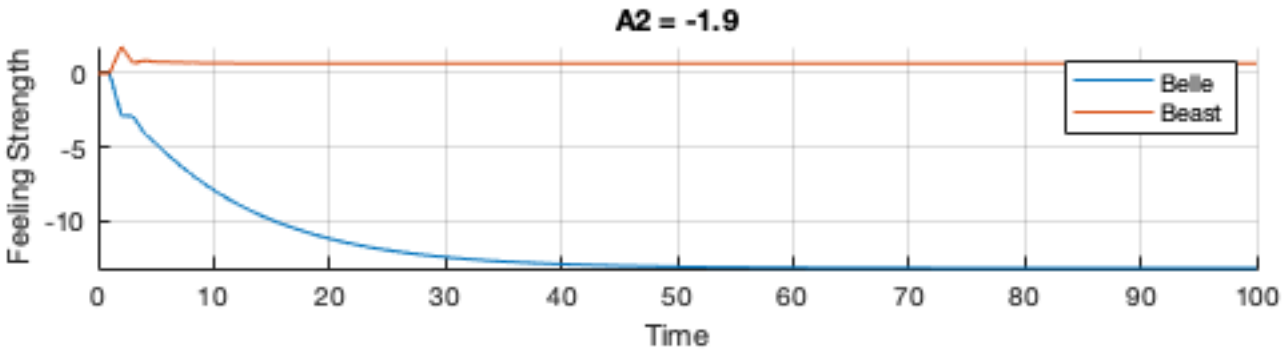
## PART A

```
for k = 2:N-1
   A1 = 1.2;
   A2 = -1.9;
   R1 = (exp(x2(k)) - exp(-x2(k)))/(exp(x2(k)) + exp(-x2(k)));
   R2 = (2*exp(x1(k)) - 2*exp(-x1(k)))/(exp(x1(k)) + 2*exp(-x1(k)));
   fx1(k) = -alpha_1*x1(k) + R1 + A2;
   fx2(k) = -alpha_2*x2(k) + R2 + A1;

   x1(k+1) = x1(k) + (3*T)./(2)*fx1(k) - (T/2)*fx1(k-1); %AB2
   x2(k+1) = x2(k) + (3*T)./(2)*fx2(k) - (T/2)*fx2(k-1);
end

figure;
subplot(3,1,1)
grid on
hold on
plot(t,x1)
plot(t,x2)
hold off
title('A2 = -1.9')
xlabel('Time')
```

```
ylabel('Feeling Strength')
legend('Belle','Beast')
```




## PART B

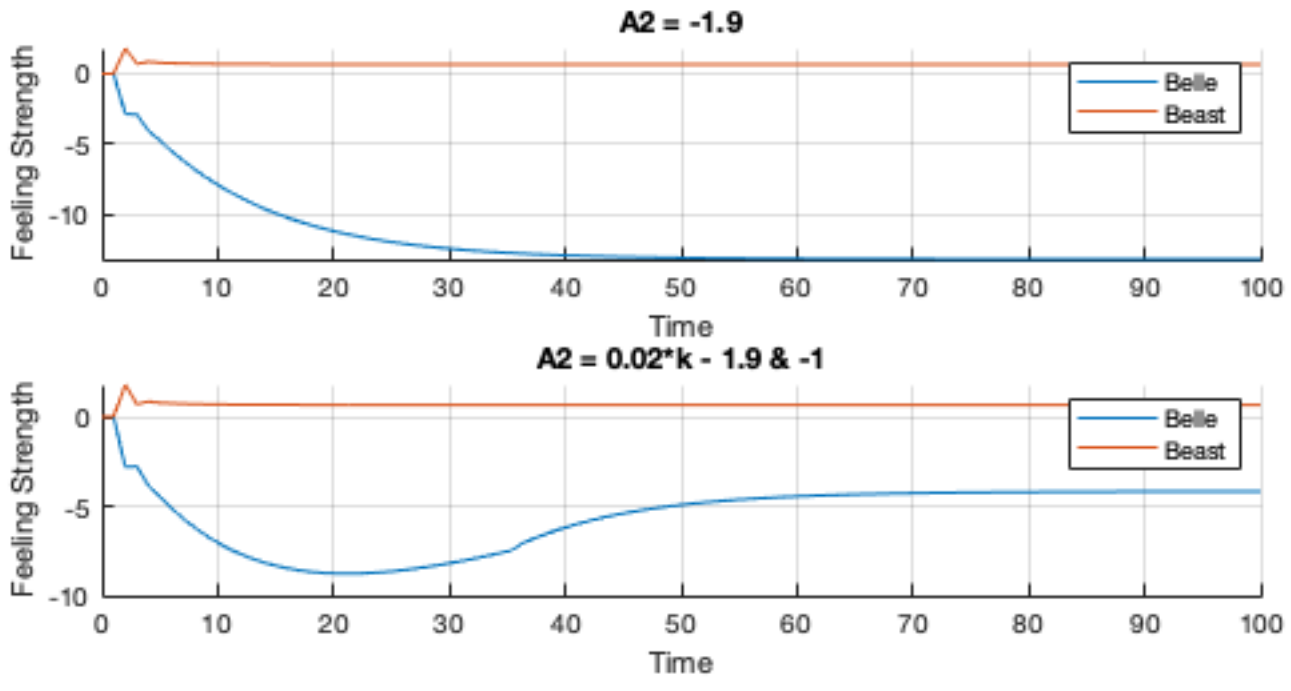
```
for k = 2:N-1
   A1 = 1.2;
   if k<=35
       A2 = 0.02*k - 1.9;
   else
       A2  = -1;
   end

   R1 = (exp(x2(k)) - exp(-x2(k)))/(exp(x2(k)) + exp(-x2(k)));
   R2 = (2*exp(x1(k)) - 2*exp(-x1(k)))/(exp(x1(k)) + 2*exp(-x1(k)));
   fx1(k) = -alpha_1*x1(k) + R1 + A2;
   fx2(k) = -alpha_2*x2(k) + R2 + A1;

   x1(k+1) = x1(k) + (3*T)./(2)*fx1(k) - (T/2)*fx1(k-1);
   x2(k+1) = x2(k) + (3*T)./(2)*fx2(k) - (T/2)*fx2(k-1);
end

subplot(3,1,2)
grid on
hold on
plot(t,x1)
plot(t,x2)
hold off
```

```
title('A2 = 0.02*k - 1.9 & -1')
xlabel('Time')
ylabel('Feeling Strength')
legend('Belle','Beast')
```




## PART C

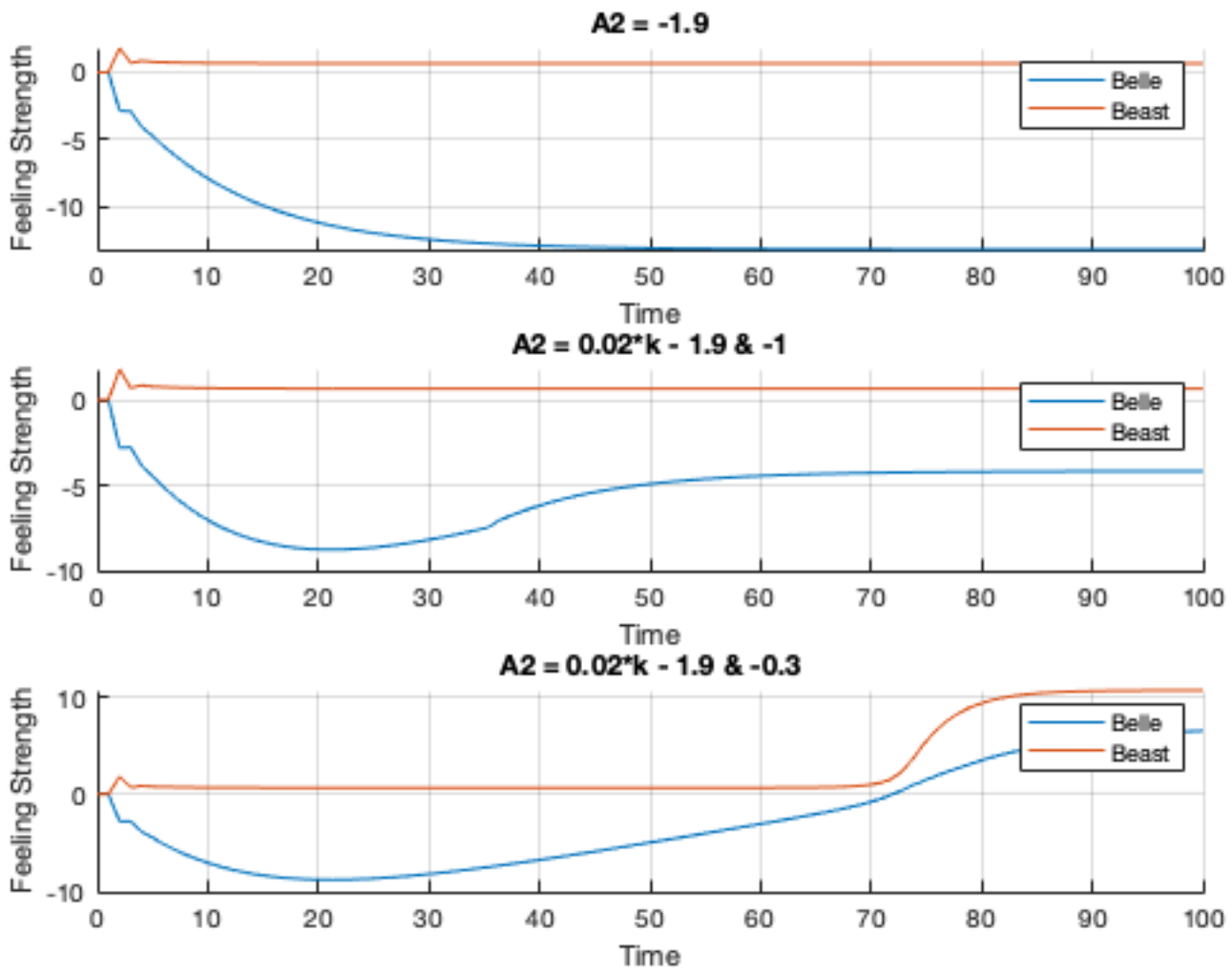
```
for k = 2:N-1
   A1 = 1.2;
   if k<=80
       A2 = 0.02*k - 1.9;
   else
       A2  = -0.3;
   end

   R1 = (exp(x2(k)) - exp(-x2(k)))/(exp(x2(k)) + exp(-x2(k)));
   R2 = (2*exp(x1(k)) - 2*exp(-x1(k)))/(exp(x1(k)) + 2*exp(-x1(k)));
   fx1(k) = -alpha_1*x1(k) + R1 + A2;
   fx2(k) = -alpha_2*x2(k) + R2 + A1;

   x1(k+1) = x1(k) + (3*T)./(2)*fx1(k) - (T/2)*fx1(k-1);
   x2(k+1) = x2(k) + (3*T)./(2)*fx2(k) - (T/2)*fx2(k-1);
end

subplot(3,1,3)
grid on
hold on
plot(t,x1)
```

```
plot(t,x2)
hold off
title('A2 = 0.02*k - 1.9 & -0.3')
xlabel('Time')
ylabel('Feeling Strength')
legend('Belle','Beast')
```




## PART D

```
disp('The third simulation fits the story best because it is the only one where Belle''s feeli
ngs cross 0, meaning she actually falls in love with the beast.')
```

```
The third simulation fits the story best because it is the only one where Belle's feelings cro
ss 0, meaning she actually falls in love with the beast.
```

---

*Published with MATLAB® R2018a*