

Simulink Model Code:

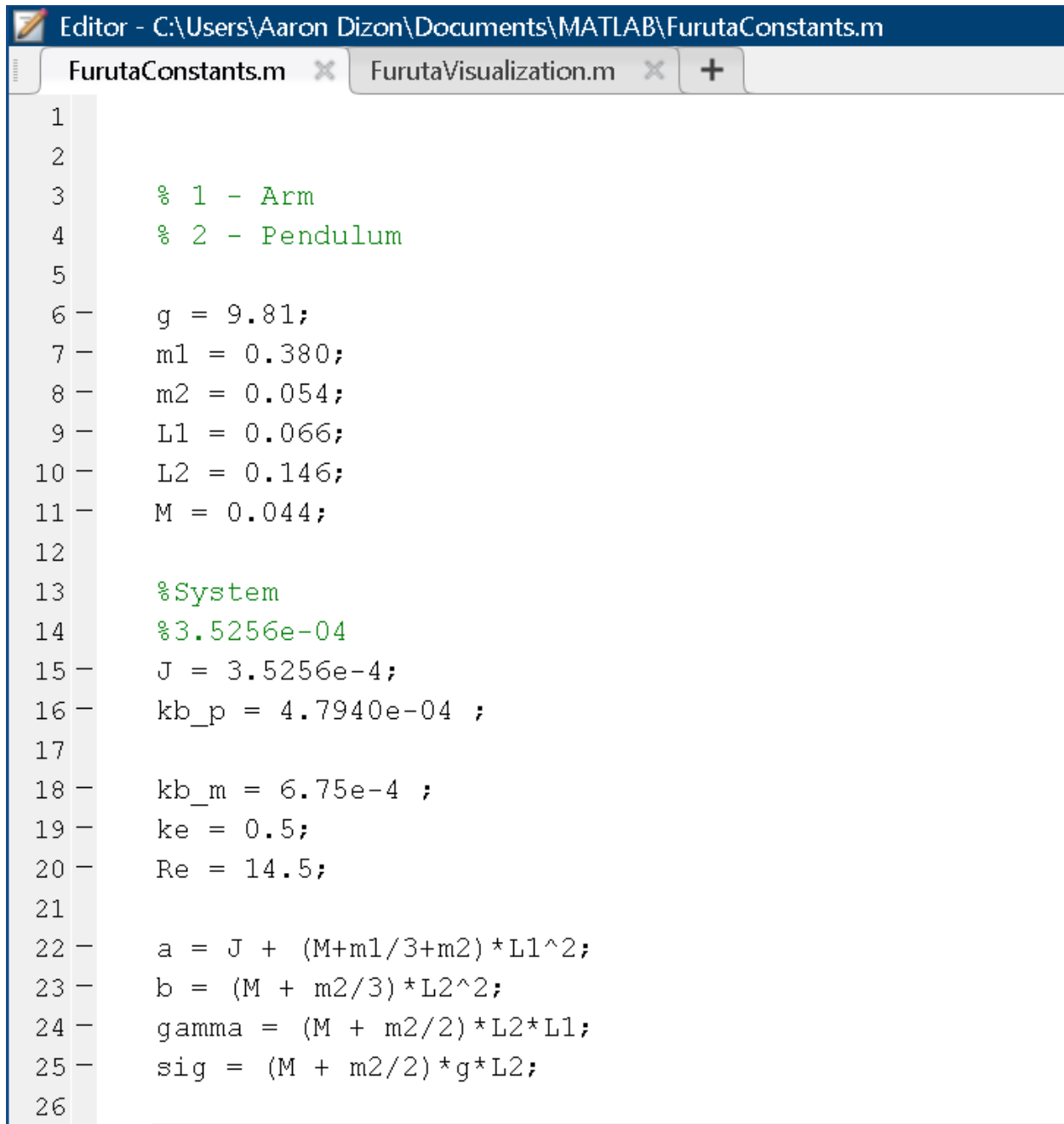
```
Editor - C:\Users\Aaron Dizon\Documents\MATLAB\FurutaVisualization.m
FurutaConstants.m  FurutaVisualization.m  +
1  %Aaron Dizon, Michael Korhummel, Efrain Cobian - Group Project 3
2
3  %Starting view
4  view(135,20)
5  %Define Graph Axis
6  AL = 5;
7
8  grid on
9
10 %Rotatary arm length
11 LArm1=4.5;
12 %Pendulum length
13 LArm2=3.5;
14
15 Xh=[0 ; LArm1]';
16 Yh=[0 ; 0]';
17 Zh=[0 ; 0]';
18
19 Xv=[Xh(2) ; LArm1]';
20 Yv=[Yh(2) ; 0]';
21 Zv=[Zh(2) ; -LArm2]';
22
23 hold on
24 Harm = fill3(Xh,Yh,Zh,'b');
25 Varm = fill3(Xv,Yv,Zv,'g');
26
27 s=8;
28 M=scatter3(Xv(2),Yv(2),Zv(2),s,'filled','MarkerFaceColor','b','MarkerEdgeColor','k')
29
```

```
Editor - C:\Users\Aaron Dizon\Documents\MATLAB\FurutaVisualization.m
FurutaConstants.m x FurutaVisualization.m x +
31 - axis([-AL AL -AL AL -AL AL]);
32
33 - thet=0;
34 - phi=0;
35 - c = [0 0 0];
36
37 - TXT=title('Time: ')
38
39 - for t=1:20:size(simTheta,1)
40 -     TXT2=sprintf('Time: %.2f', simt(t));
41 -     set(TXT, 'String', TXT2);
42
43 -     phi=simPhi(t);
44 -     thet =-simTheta(t);
45
46 -     Xh(2)= L1*cos(phi);
47 -     Yh(2)=L1*sin(phi);
48
49 -     Xva = 0;
50 -     Yva = L2*sin(thet);
51 -     Zva = -L2*cos(thet);
52
53 -     Xvb = Xva*cos(phi)-Yva*sin(phi)+L1*cos(phi);
54 -     Yvb = Xva*sin(phi)+Yva*cos(phi) + L1*sin(phi);
55 -     Zvb = Zva;
56
57
```

```
Editor - C:\Users\Aaron Dizon\Documents\MATLAB\FurutaVisualization.m
FurutaConstants.m x FurutaVisualization.m x +
56
57
58 -     Xv=[Xh(2);Xvb]';
59 -     Yv=[Yh(2);Yvb]';
60 -     Zv=[ 0 ;Zvb]';
61
62 -     set(Harm, 'XData', Xh);
63 -     set(Harm, 'YData', Yh);
64 -     set(Harm, 'ZData', Zh);
65 -     %set(Harm, 'FaceVertexCData', C);
66
67 -     set(Varm, 'XData', Xv);
68 -     set(Varm, 'YData', Yv);
69 -     set(Varm, 'ZData', Zv);
70 -     %set(Varm, 'FaceVertexCData', C);
71 -     rem(t, 30)
72
73
```

```
78
79
80
81 -     set(M, 'XData', Xv(2));
82 -     set(M, 'YData', Yv(2));
83 -     set(M, 'ZData', Zv(2));
84
85 -     drawnow;
86
87     %     pause(0.0010);
88 - end
```

Constants Code:



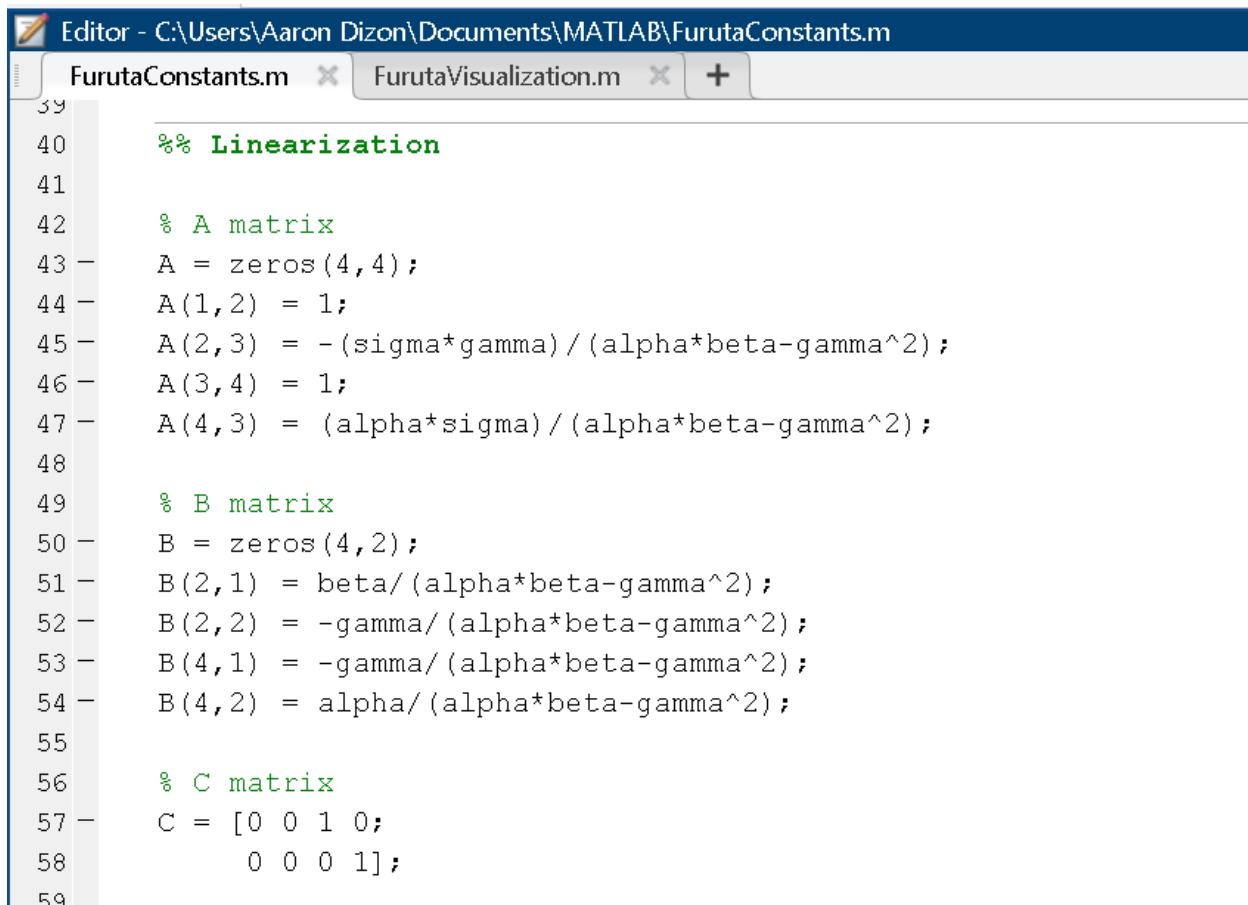
The image shows a MATLAB Editor window with the title bar "Editor - C:\Users\Aaron Dizon\Documents\MATLAB\FurutaConstants.m". The window contains two tabs: "FurutaConstants.m" and "FurutaVisualization.m". The "FurutaConstants.m" tab is active, displaying a script with 26 lines of code. The code defines constants for a system, including masses, lengths, moments of inertia, and stiffnesses, and calculates derived parameters a, b, gamma, and sig.

```
1
2
3     % 1 - Arm
4     % 2 - Pendulum
5
6     g = 9.81;
7     m1 = 0.380;
8     m2 = 0.054;
9     L1 = 0.066;
10    L2 = 0.146;
11    M = 0.044;
12
13    %System
14    %3.5256e-04
15    J = 3.5256e-4;
16    kb_p = 4.7940e-04 ;
17
18    kb_m = 6.75e-4 ;
19    ke = 0.5;
20    Re = 14.5;
21
22    a = J + (M+m1/3+m2)*L1^2;
23    b = (M + m2/3)*L2^2;
24    gamma = (M + m2/2)*L2*L1;
25    sig = (M + m2/2)*g*L2;
26
```

```

27 %% Simulation parameters
28
29 initial_state = pi;
30 Ts = 0.001;
31 dtDisc = 0.01;
32 Reference = [0 0 0 0];
33 %Dead Zone
34 Zn = 3;
35
36 StepX = 10;
37 distrub = 12;
38 disturb = distrub*pi/180;
39

```



```

Editor - C:\Users\Aaron Dizon\Documents\MATLAB\FurutaConstants.m
FurutaConstants.m x FurutaVisualization.m x +
39
40 %% Linearization
41
42 % A matrix
43 A = zeros(4,4);
44 A(1,2) = 1;
45 A(2,3) = -(sigma*gamma)/(alpha*beta-gamma^2);
46 A(3,4) = 1;
47 A(4,3) = (alpha*sigma)/(alpha*beta-gamma^2);
48
49 % B matrix
50 B = zeros(4,2);
51 B(2,1) = beta/(alpha*beta-gamma^2);
52 B(2,2) = -gamma/(alpha*beta-gamma^2);
53 B(4,1) = -gamma/(alpha*beta-gamma^2);
54 B(4,2) = alpha/(alpha*beta-gamma^2);
55
56 % C matrix
57 C = [0 0 1 0;
58      0 0 0 1];
59

```

Simulink Model:

