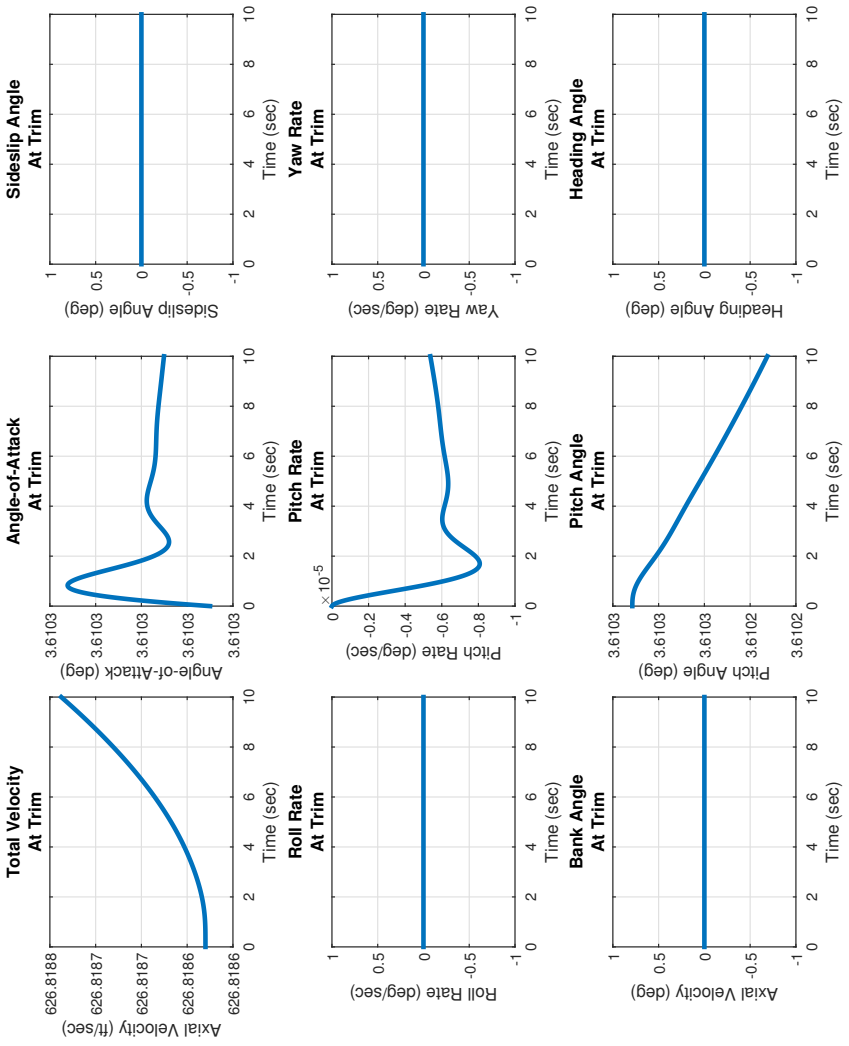

Figure 1: Trim Simulation Graphical Solution

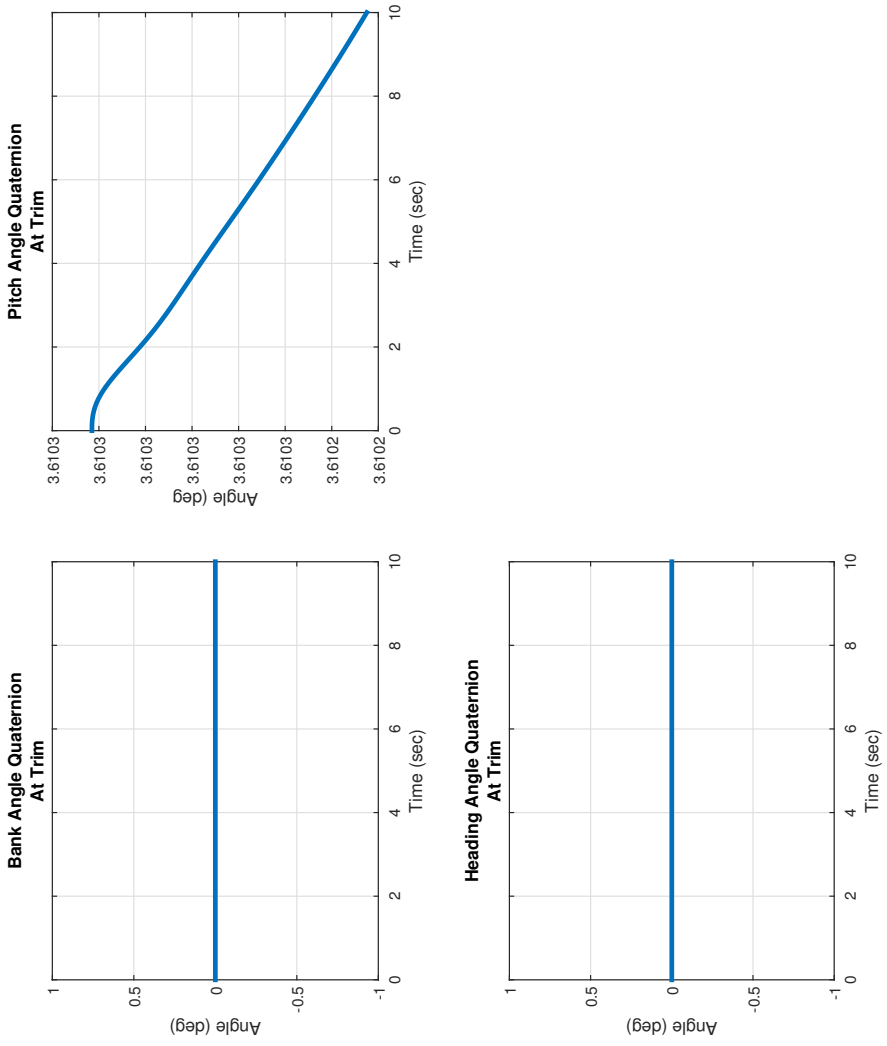

Figure 2: Trim Simulation Quaternion Model Graphical Solution

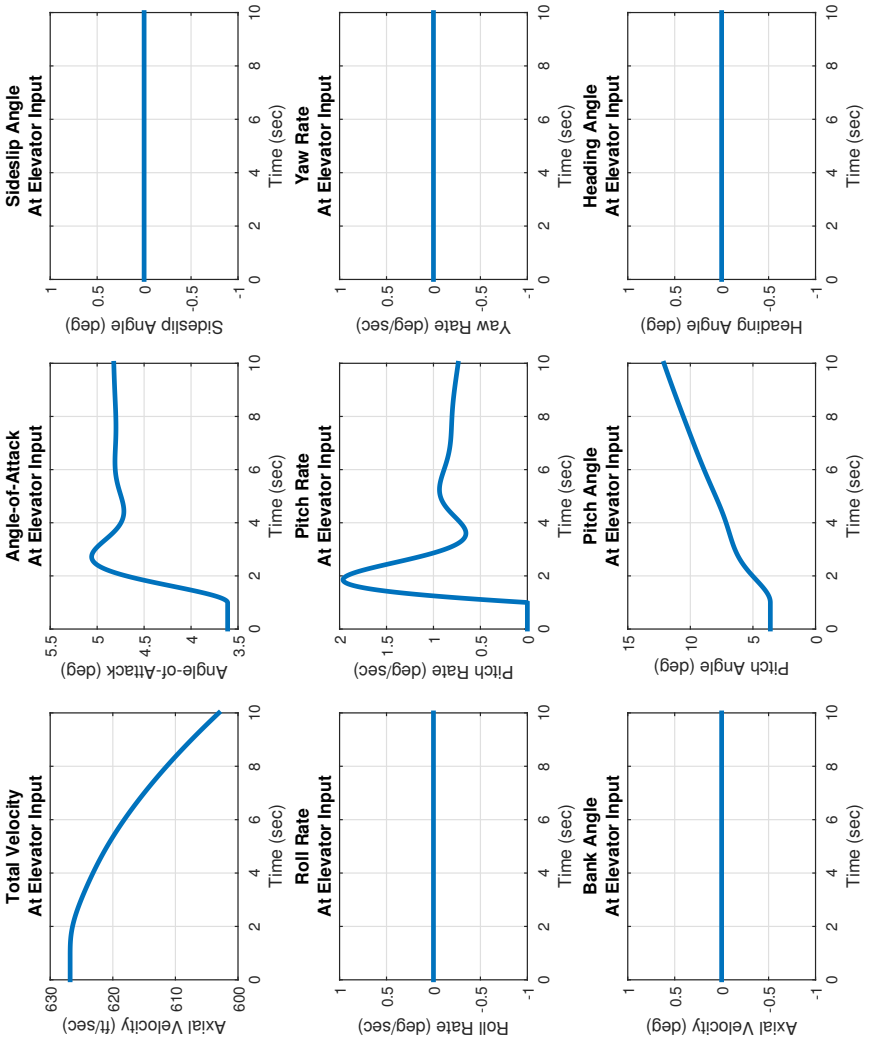

Figure 3: Elevator Input Simulation Graphical Solution

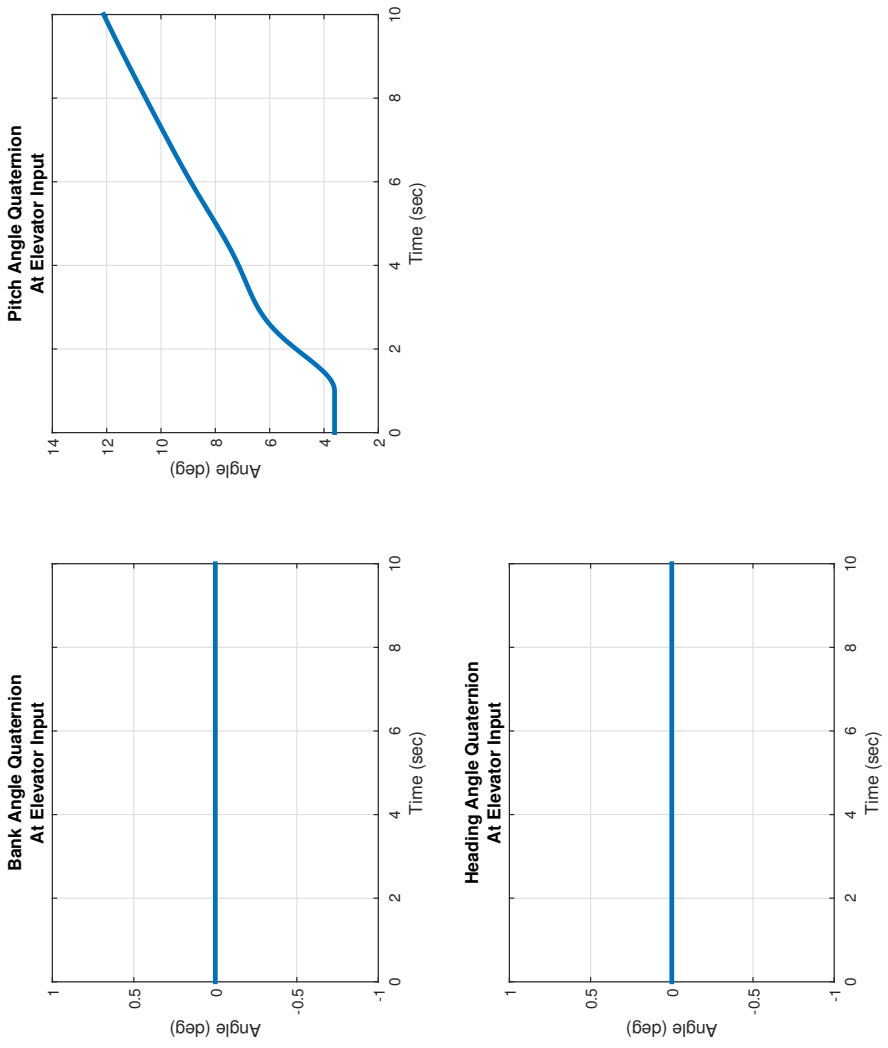

Figure 4: Elevator Input Simulation Quaternion Model Graphical Solution

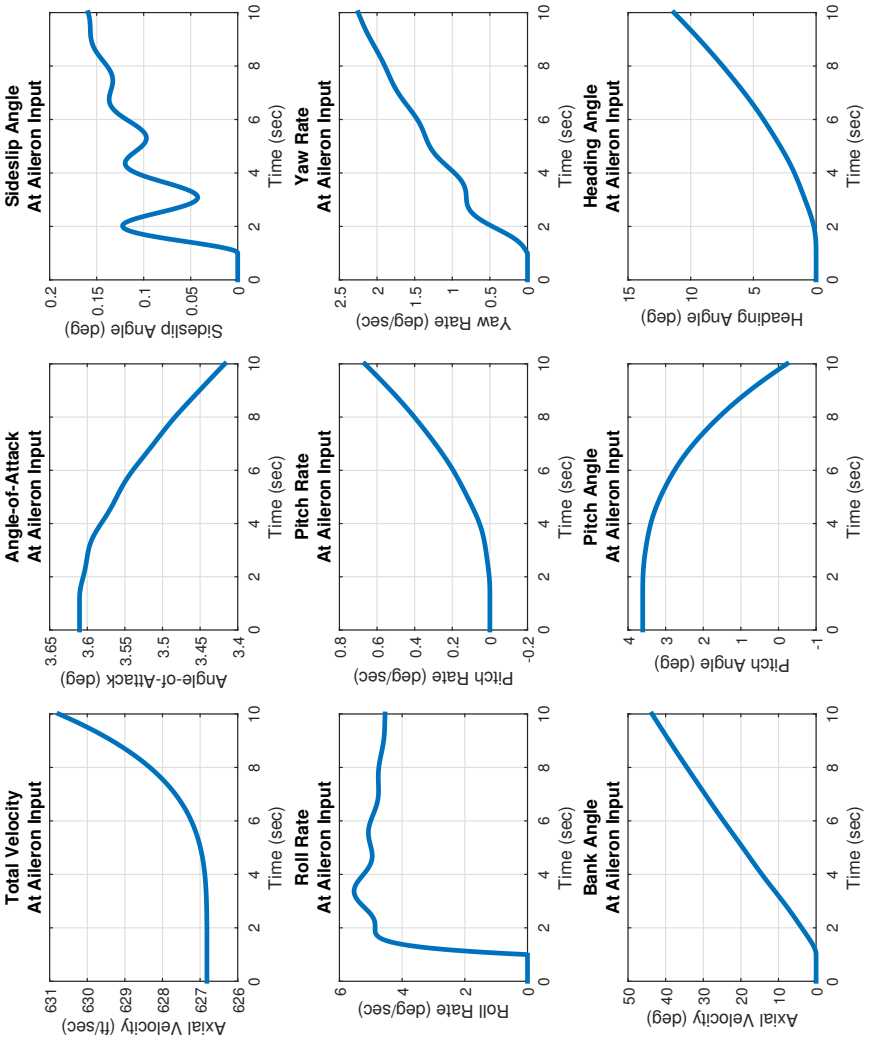

Figure 5: Aileron Input Simulation Graphical Solution

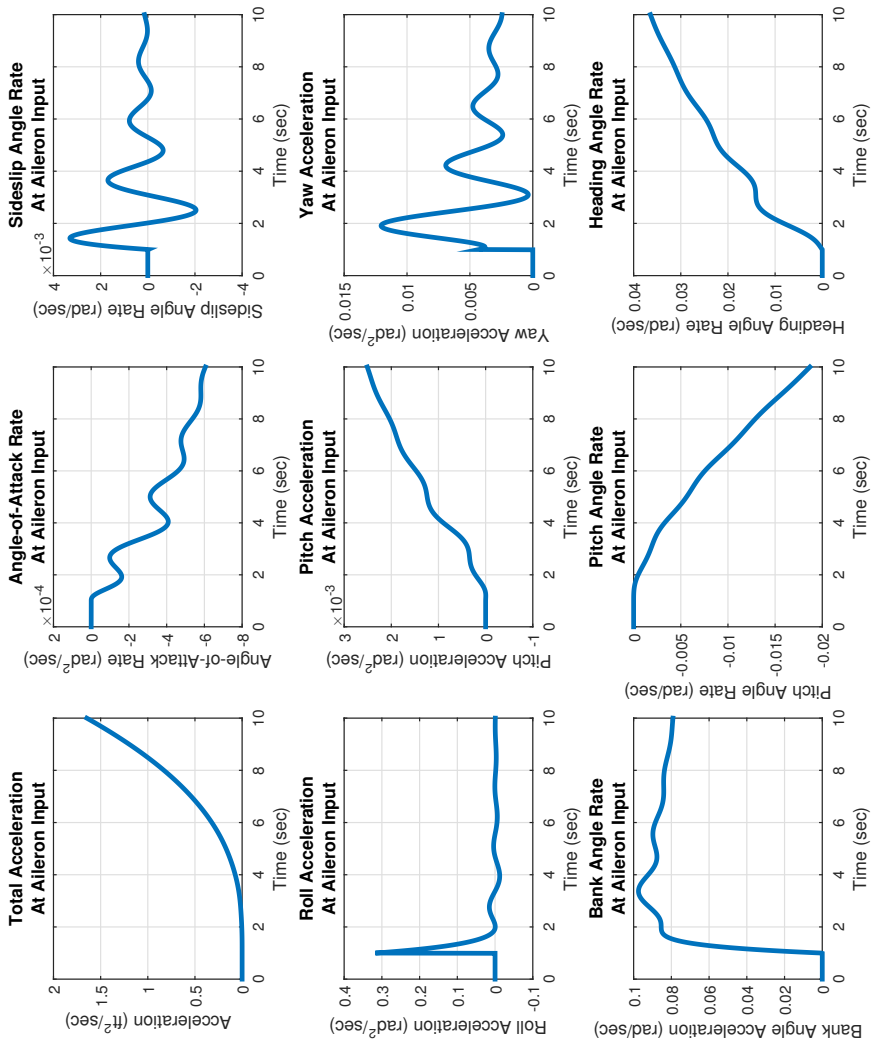

Figure 6: Aileron Input Simulation Derivative Graphical Solution

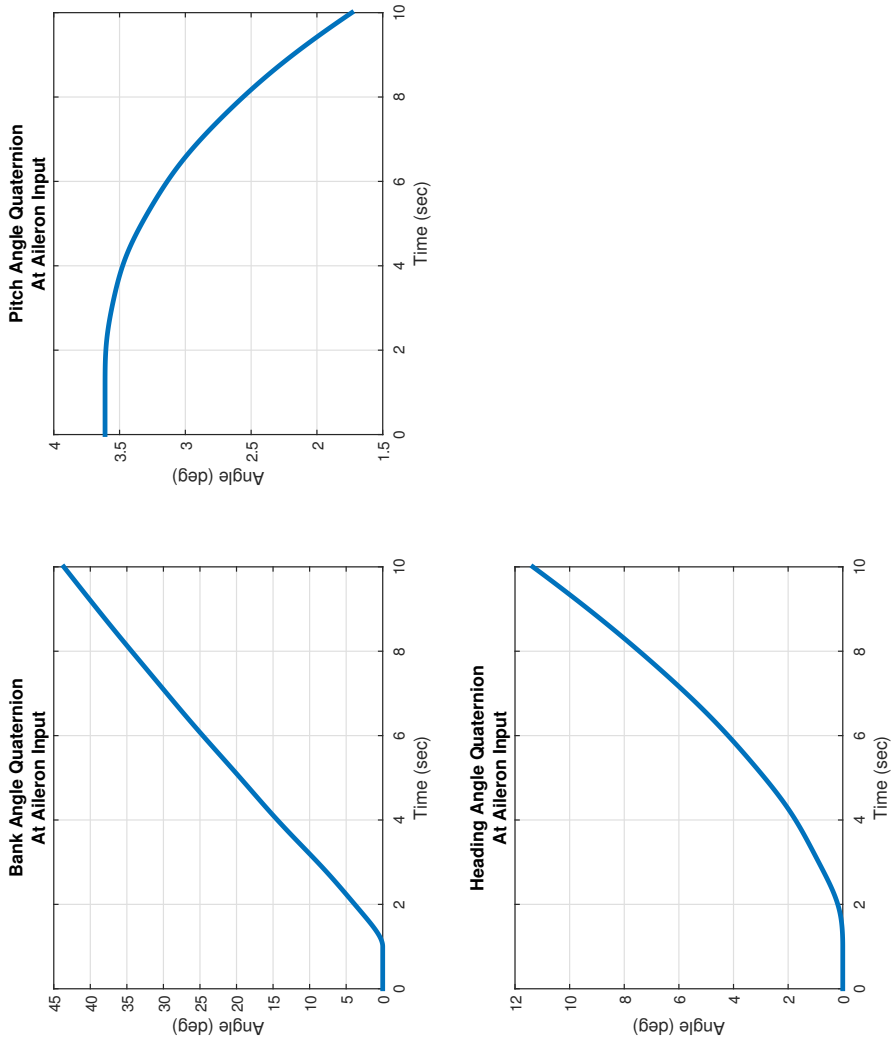

Figure 7: Aileron Input Simulation Quaternion Model Graphical Solution

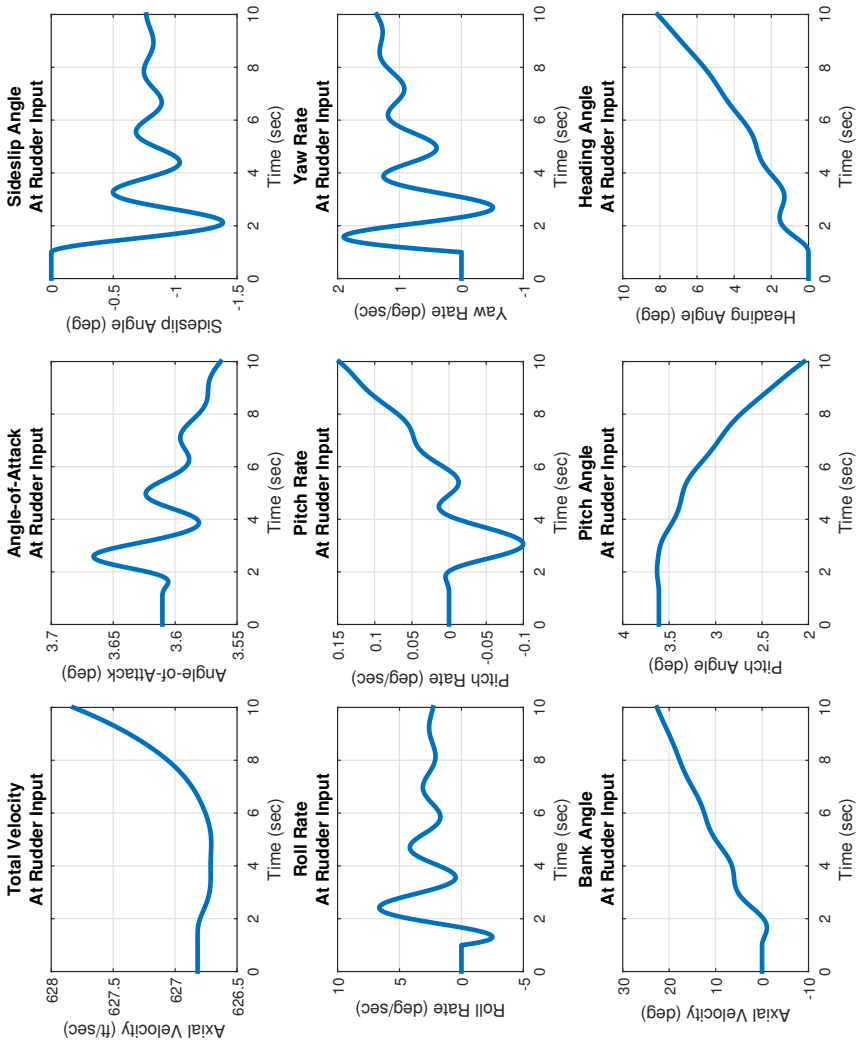

Figure 8: Rudder Input Simulation Graphical Solution

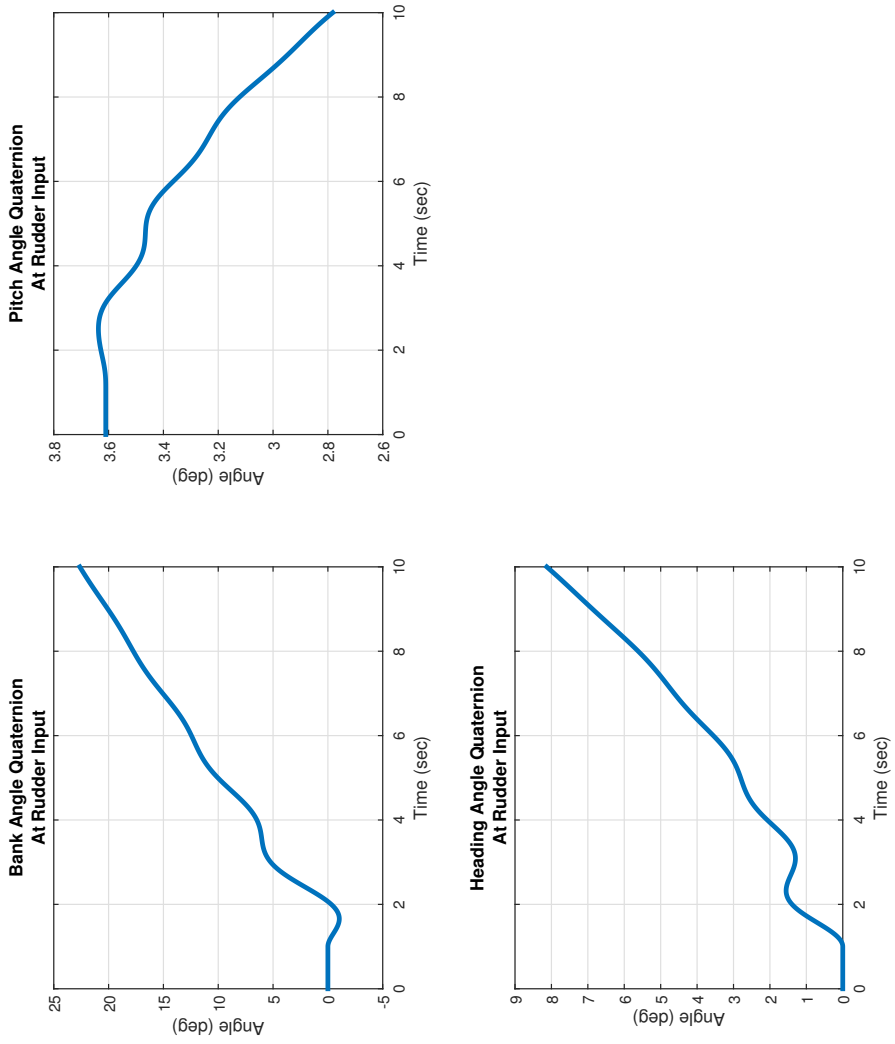

Figure 9: Rudder Input Simulation Quaternion Model Graphical Solution

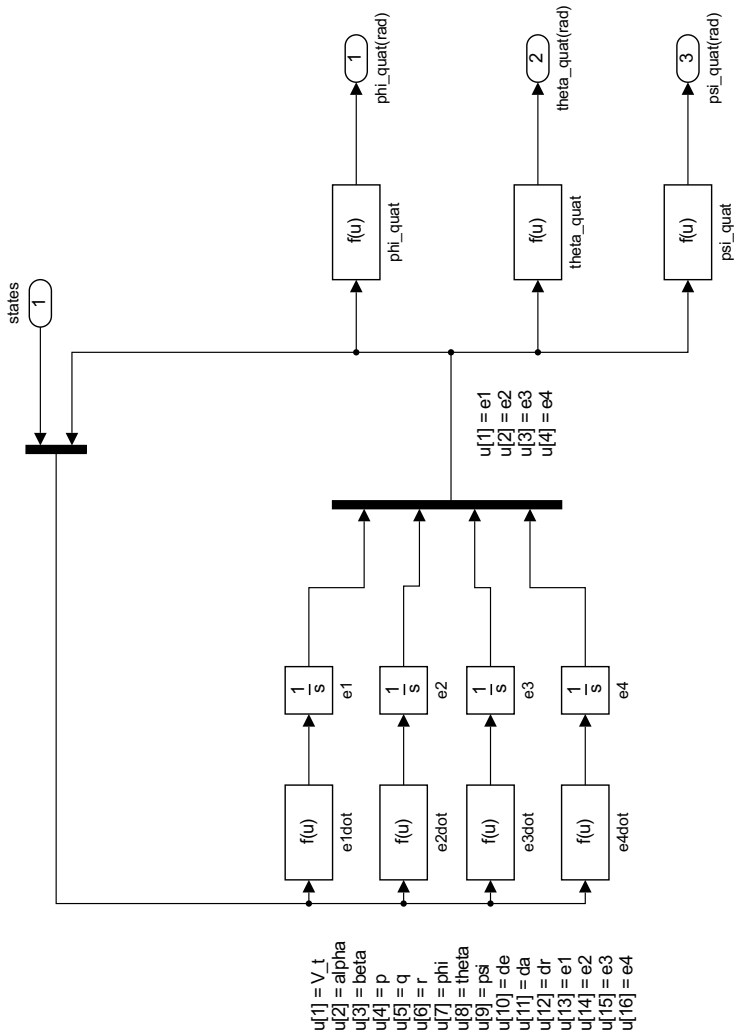

Figure 10: Simulink Diagram

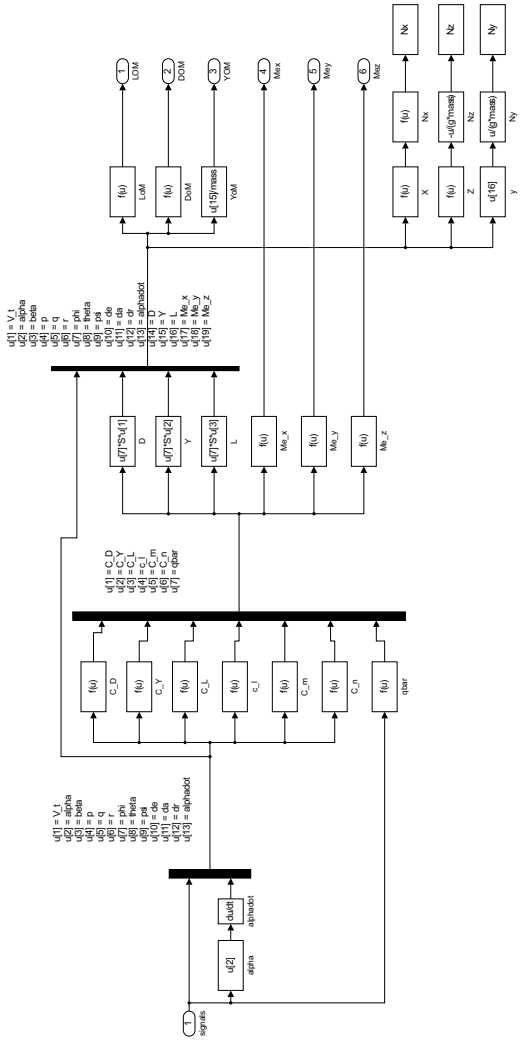

Figure 11: Simulink Diagram

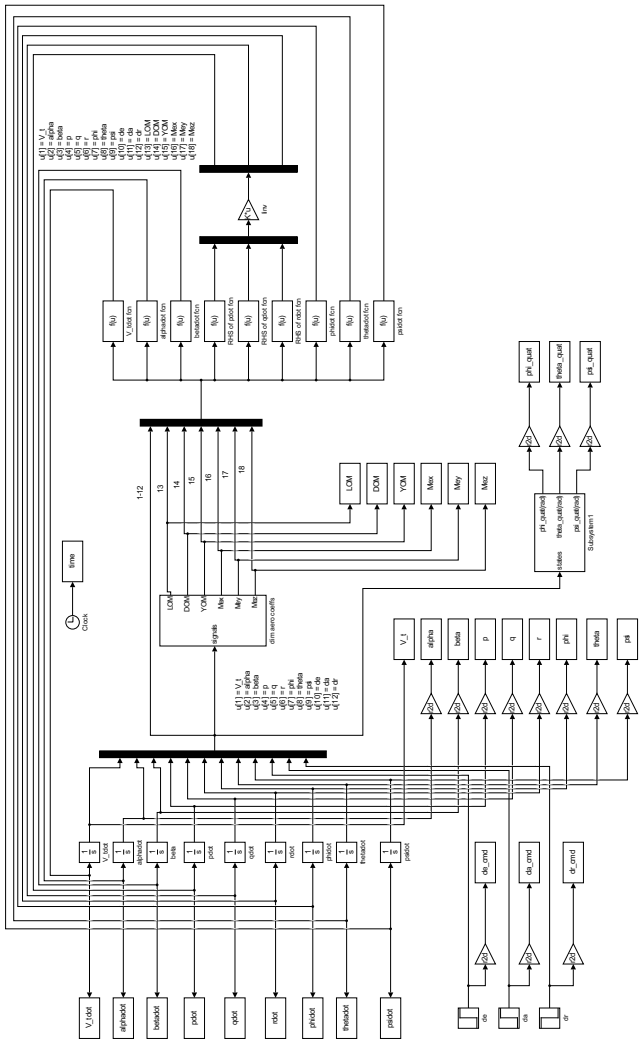

Figure 12: Simulink Diagram

```
% Project_4_m.m
% Clair Cunningham

clear all; close all; clc
fid = fopen('Project_4.txt','w+');

set(0,'Units','pixels')
Pix_SS = get(0,'screensize');
%Position Center At 90 percent screen in vector form
    :[left bottom width height]
width = Pix_SS(3)*.90;
height = Pix_SS(4)*.90;
taskbar = 40;
left = (Pix_SS(3)-width-Pix_SS(1))/2;
bottom = (Pix_SS(4)-height-Pix_SS(2))/2+taskbar;
pos_size = [left bottom width height-taskbar];

%% Numbers
% Conversion factor from radians to degrees
r2d = 180/pi;

%Conversion factor from degrees to radians
d2r = pi/180;
pd2pr = 180/pi;

% Aircraft Properties
i_xx = 8890.63; %slug-ft^2
i_yy = 71973.5; %slug-ft^2
i_zz = 77141.1; %slug-ft^2
i_xz = 181.119; %slug-ft^2
i_xy = 0.0; %slug-ft^2
i_yz = 0.0; %slug-ft^2
I = [i_xx -i_xy -i_xz; -i_xy i_yy -i_yz; -i_xz -i_yz
    i_zz];
Iinv = inv(I);
S = 300; % ft^2
cbar = 11.31; % ft
b = 30; % ft
```

```
37 mass = 762.8447; % slugs
38
39
40 % Properties of Air
41 rho = 0.0014962376; % slugs/ft^2
42 g = 32.17561865; % ft/sec^2
43 % qbar = 0.5*rho*V_t^2; % lbf/ft^2
44
45 %+++++++++++++++++++++++++ Degree Format
      ++++++++++++++++++++++++
46 % Initial "Trim" Conditions
47 alpha_0_d = 3.6102915; % deg
48 beta_0_d = 0; % deg
49 p_0_d = 0; % deg
50 q_0_d = 0; % deg
51 r_0_d = 0; % deg
52 phi_0_d = 0; % deg
53 theta_0_d = 3.6102915; % deg
54 psi_0_d = 0; % deg
55 de_0_d = -3.03804303; % deg
56 da_0_d = 0; % deg
57 dr_0_d = 0; % deg
58 df_0_d = 1.5; % deg
59
60 % Coefficient of Lift
61 c_L_0 = 0.004608463; %       confirmed
62 c_L_alpha_d = 0.0794655; %1/deg
63 c_L_q_d = 0.0508476; %1/deg
64 c_L_alphadot_d = 0.0; %1/deg
65 c_L_de_d = 0.0121988; %1/deg
66 c_L_df_d = 0.0144389; %1/deg
67
68 % Coefficient of Drag
69 c_D_0 = 0.01192128;
70 c_D_alpha_d = 0.00550063; %1/deg
71 c_D_q_d = 0.00315057; %1/deg
72 c_D_alphadot_d = 0.0; %1/deg
73 c_D_de_d = -0.000587647; %1/deg
```

```
74  c_d_df_d = 0.00136385; %1/deg
75
76  % Coefficient of Side Force
77  c_y_0 = 0.0;
78  c_y_beta_d = -0.0219309; %1/deg
79  c_y_p_d = 0.00133787; %1/deg
80  c_y_r_d = 0.0094053; %1/deg
81  c_y_da_d = 0.00049355; %1/deg
82  c_y_dr_d = 0.00293048; %1/deg
83
84  % Coefficient of Rolling Moment
85  c_l_0 = 0.0;
86  c_l_beta_d = -0.00173748; %1/deg
87  c_l_p_d = -0.00739342; %1/deg
88  c_l_r_d = 0.0000699792; %1/deg
89  c_l_da_d = -0.00213984; %1/deg
90  c_l_dr_d = 0.000479021; %1/deg
91
92  % Coefficient of Pitching Moment
93  c_m_0 = -0.02092347;
94  c_m_alpha_d = -0.0041873; %1/deg
95  c_m_q_d = -0.110661; %1/deg
96  c_m_alphadot_d = 0.0; %1/deg
97  c_m_de_d = -0.0115767; %1/deg
98  c_m_df_d = 0.000580220; %1/deg
99
100 % Coefficient of Yawing Moment
101 c_n_0 = 0.0;
102 c_n_beta_d = 0.00320831; %1/deg
103 c_n_p_d = -0.000432575; %1/deg
104 c_n_r_d = -0.00886783; %1/deg
105 c_n_da_d = -0.000206591; %1/deg
106 c_n_dr_d = -0.00144865; %1/deg
107
108 %+++++++++++++++++++++++++ Radian Format
      ++++++++++++++++++++++++
109 % Initial "Trim" Conditions
110 V_t_0 = 626.81863; % ft/sec
```

```
111 T_0 = 3146.482666; % lb
112
113 % Conversion factor from radians to degrees
114 % r2d = 180/pi;
115
116 %Conversion factor from degrees to radians
117 % d2r = pi/180;
118 % pd2pr = 180/pi;
119
120 alpha_0 = alpha_0_d*d2r;%
121 beta_0 = beta_0_d*d2r; %
122 p_0 = p_0_d*d2r; %
123 q_0 = q_0_d*d2r; %
124 r_0 = r_0_d*d2r; %
125 phi_0 = phi_0_d*d2r; %
126 theta_0 = theta_0_d*d2r; %
127 psi_0 = psi_0_d*d2r; %
128 de_0 = de_0_d*d2r; %
129 da_0 = da_0_d*d2r; %
130 dr_0 = dr_0_d*d2r; %
131 df_0 = df_0_d*d2r; %
132
133 % Coefficient of Life
134 c_L_0 = 0.004608463;
135 c_L_alpha = c_L_alpha_d*pd2pr; %1/rad
136 c_L_q = c_L_q_d*pd2pr; %1/rad
137 c_L_alphadot = c_L_alphadot_d*pd2pr; %1/rad
138 c_L_de = c_L_de_d*pd2pr; %1/rad
139 c_L_df = c_L_df_d*pd2pr; %1/rad
140
141 % Coefficient of Drag
142 c_D_0 = 0.01192128;
143 c_D_alpha = c_D_alpha_d*pd2pr; %1/rad
144 c_D_q = c_D_q_d*pd2pr; %1/rad
145 c_D_alphadot = c_D_alphadot_d*pd2pr; %1/rad
146 c_D_de = c_D_de_d*pd2pr; %1/rad
147 c_D_df = c_d_df_d*pd2pr; %1/rad
148
```

```
149 % Coefficient of Side Force
150 c_y_0 = 0.0;
151 c_y_beta = c_y_beta_d*pd2pr; %1/rad
152 c_y_p = c_y_p_d*pd2pr; %1/rad
153 c_y_r = c_y_r_d*pd2pr; %1/rad
154 c_y_da = c_y_da_d*pd2pr; %1/rad
155 c_y_dr = c_y_dr_d*pd2pr; %1/rad
156
157 % Coefficient of Rolling Moment
158 c_l_0 = 0.0;
159 c_l_beta = c_l_beta_d*pd2pr; %1/rad
160 c_l_p = c_l_p_d*pd2pr; %1/rad
161 c_l_r = c_l_r_d*pd2pr; %1/rad
162 c_l_da = c_l_da_d*pd2pr; %1/rad
163 c_l_dr = c_l_dr_d*pd2pr; %1/rad
164
165 % Coefficient of Pitching Moment
166 c_m_0 = -0.02092347;
167 c_m_alpha = c_m_alpha_d*pd2pr; %1/rad
168 c_m_q = c_m_q_d*pd2pr; %1/rad
169 c_m_alphadot = c_m_alphadot_d*pd2pr; %1/rad
170 c_m_de = c_m_de_d*pd2pr; %1/rad
171 c_m_df = c_m_df_d*pd2pr; %1/rad
172
173 % Coefficient of Yawing Moment
174 c_n_0 = 0.0;
175 c_n_beta = c_n_beta_d*pd2pr; %1/rad
176 c_n_p = c_n_p_d*pd2pr; %1/rad
177 c_n_r = c_n_r_d*pd2pr; %1/rad
178 c_n_da = c_n_da_d*pd2pr; %1/rad
179 c_n_dr = c_n_dr_d*pd2pr; %1/rad
180
181 % Quaternion Initial Conditions
182 e1_0 = cos(psi_0/2)*cos(theta_0/2)*cos(phi_0/2)+sin(
       psi_0/2)*sin(theta_0/2)*sin(phi_0/2);
183 e2_0 = cos(psi_0/2)*cos(theta_0/2)*sin(phi_0/2)-sin(
       psi_0/2)*sin(theta_0/2)*cos(phi_0/2);
184 e3_0 = cos(psi_0/2)*sin(theta_0/2)*cos(phi_0/2)+sin(
```

```
   psi_0/2)*cos(theta_0/2)*sin(phi_0/2);
185 e4_0 = sin(psi_0/2)*cos(theta_0/2)*cos(phi_0/2)-cos(
   psi_0/2)*sin(theta_0/2)*sin(phi_0/2);
186
187 %% Trim Simulation
188 num = 1;
189 %Inputs to Elevator, Aileron, or Rudder
190     % Degs
191     de_d = 0;
192     da_d = 0;
193     df_d = 0;
194     dr_d = 0;
195     % Radians
196     de = de_d*d2r;
197     da = da_d*d2r;
198     df = df_d*d2r;
199     dr = dr_d*d2r;
200 %Run Simulation
201 sim('Project_4_s')
202 %Call up next figure
203 fig = figure('OuterPosition',pos_size,'
   PaperPositionMode','auto');
204 fig.Name = 'Trim Simulation';
205 %Changes Paper Print Orientation to landscape on a
   per figure basic
206 orient landscape
207 %Output plots to called figure
208 subplot(3,3,1)
209 plot(time,V_t,'LineWidth',3.0); title({'Total
   Velocity','At Trim'});xlabel('Time (sec)');ylabel
   ('Axial Velocity (ft/sec)'); grid on
210 subplot(3,3,2)
211 plot(time,alpha,'LineWidth',3.0); title({'Angle-of-
   Attack','At Trim'});xlabel('Time (sec)');ylabel('
   Angle-of-Attack (deg)'); grid on
212 subplot(3,3,3)
213 plot(time,beta,'LineWidth',3.0); title({'Sideslip
   Angle','At Trim'});xlabel('Time (sec)');ylabel('
```

```
   Sideslip Angle (deg)'); grid on
214 subplot(3,3,4)
215 plot(time,p,'LineWidth',3.0); title({'Roll Rate','At
    Trim'});xlabel('Time (sec)');ylabel('Roll Rate (
   deg/sec)'); grid on
216 subplot(3,3,5)
217 plot(time,q,'LineWidth',3.0); title({'Pitch Rate','
   At Trim'});xlabel('Time (sec)');ylabel('Pitch
   Rate (deg/sec)'); grid on
218 subplot(3,3,6)
219 plot(time,r,'LineWidth',3.0); title({'Yaw Rate','At
   Trim'});xlabel('Time (sec)');ylabel('Yaw Rate (
   deg/sec)'); grid on
220 subplot(3,3,7)
221 plot(time,phi,'LineWidth',3.0); title({'Bank Angle',
   'At Trim'});xlabel('Time (sec)');ylabel('Axial
   Velocity (deg)'); grid on
222 subplot(3,3,8)
223 plot(time,theta,'LineWidth',3.0); title({'Pitch
   Angle','At Trim'});xlabel('Time (sec)');ylabel('
   Pitch Angle (deg)'); grid on
224 subplot(3,3,9)
225 plot(time,psi,'LineWidth',3.0); title({'Heading
   Angle','At Trim'});xlabel('Time (sec)');ylabel('
   Heading Angle (deg)'); grid on
226 % %'Paperposition', [left bottom width height]
227   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
      ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
228 %  print('-P\\meprint2\gle-2120-pr02c',fig)
229 name = [strrep(fig.Name,' ','_')];
230 print(fig,'-depsc','-noui','-painters',name);
231 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
   fill} Clair Cunningham \\hspace*{\\fill} Problem
   %d}\n',num);
232 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
   centering\\includegraphics[keepaspectratio=true,
   height=1\\textheight,width=1\\textwidth,angle
   =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
```

```
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
233
234 %Derivative Figure and Plot
235 fig = figure('OuterPosition',pos_size,'
    PaperPositionMode','auto');
236 fig.Name = 'Trim Simulation Derivative';
237 %Changes Paper Print Orientation to landscape on a
    per figure basic
238 orient landscape
239 %Output derivative plots to called figure
240 subplot(3,3,1)
241 plot(time,V_tdot,'LineWidth',3.0); title({'Total
    Acceleration','At Trim'});xlabel('Time (sec)');
    ylabel('Acceleration (ft^2/sec)'); grid on
242 subplot(3,3,2)
243 plot(time,alphadot,'LineWidth',3.0); title({'Angle-
    of-Attack Rate','At Trim'});xlabel('Time (sec)');
    ylabel('Angle-of-Attack Rate (rad/sec)'); grid on
244 subplot(3,3,3)
245 plot(time,betadot,'LineWidth',3.0); title({'Sideslip
     Angle Rate','At Trim'});xlabel('Time (sec)');
    ylabel('Sideslip Angle Rate (rad/sec)'); grid on
246 subplot(3,3,4)
247 plot(time,pdot,'LineWidth',3.0); title({'Roll
    Acceleration','At Trim'});xlabel('Time (sec)');
    ylabel('Roll Acceleration (rad^2/sec)'); grid on
248 subplot(3,3,5)
249 plot(time,qdot,'LineWidth',3.0); title({'Pitch
    Acceleration','At Trim'});xlabel('Time (sec)');
    ylabel('Pitch Acceleration (rad^2/sec)'); grid on
250 subplot(3,3,6)
251 plot(time,rdot,'LineWidth',3.0); title({'Yaw
    Acceleration','At Trim'});xlabel('Time (sec)');
    ylabel('Yaw Acceleration (rad^2/sec)'); grid on
252 subplot(3,3,7)
253 plot(time,phidot,'LineWidth',3.0); title({'Bank
    Angle Rate','At Trim'});xlabel('Time (sec)');
```

```
   ylabel('Bank Angle Rate (rad/sec)'); grid on
subplot(3,3,8)
plot(time,thetadot,'LineWidth',3.0); title({'Pitch
   Angle Rate','At Trim'});xlabel('Time (sec)');
   ylabel('Pitch Angle Rate (rad/sec)'); grid on
subplot(3,3,9)
plot(time,psidot,'LineWidth',3.0); title({'Heading
   Angle Rate','At Trim'});xlabel('Time (sec)');
   ylabel('Heading Angle Rate (rad/sec)'); grid on
% %'Paperposition', [left bottom width height]
  set(fig,'PaperPositionMode', 'manual', 'PaperUnits
     ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
%  print('-P\\meprint2\gle-2120-pr02c',fig)
% name = [strrep(fig.Name,' ','_')];
% print(fig,'-depsc','-noui','-painters',name);
% fprintf(fid,'\\sectionmark{Project \\# 4\\hspace
   *{\\fill} Clair Cunningham \\hspace*{\\fill}
   Problem %d}\n',num);
% fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
   centering\\includegraphics[keepaspectratio=true,
   height=1\\textheight,width=1\\textwidth,angle
   =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
   end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
   fig.Name);

%Quaternion Figure and Plot
fig = figure('OuterPosition',pos_size,'
   PaperPositionMode','auto');
fig.Name = 'Trim Simulation Quaternion Model';
%Changes Paper Print Orientation to landscape on a
   per figure basic
orient landscape
%Output Euler Angles Derived from Quaternion Model
subplot(2,2,1)
plot(time,phi_quat,'LineWidth',3.0); title({'Bank
   Angle Quaternion','At Trim'});xlabel('Time (sec)'
   );ylabel('Angle (deg)'); grid on
subplot(2,2,2)
```

```
275 plot(time,theta_quat,'LineWidth',3.0); title({'Pitch
        Angle Quaternion','At Trim'});xlabel('Time (sec)
    ');ylabel('Angle (deg'); grid on
276 subplot(2,2,3)
277 plot(time,psi_quat,'LineWidth',3.0); title({'Heading
        Angle Quaternion','At Trim'});xlabel('Time (sec)
    ');ylabel('Angle (deg)'); grid on
278 % %'Paperposition', [left bottom width height]
279   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
        ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
280 %  print('-P\\meprint2\gle-2120-pr02c',fig)
281 name = [strrep(fig.Name,' ','_')];
282 print(fig,'-depsc','-noui','-painters',name);
283 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
    fill} Clair Cunningham \\hspace*{\\fill} Problem
    %d}\n',num);
284 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
    centering\\includegraphics[keepaspectratio=true,
    height=1\\textheight,width=1\\textwidth,angle
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
285 %% Elevator Input Simulation
286 num = num + 1;
287 %Inputs to Elevator, Aileron, or Rudder
288     % Degs
289     de_d = -0.5;
290     da_d = 0;
291     df_d = 0;
292     dr_d = 0;
293     % Radians
294     de = de_d*d2r;
295     da = da_d*d2r;
296     df = df_d*d2r;
297     dr = dr_d*d2r;
298
299 %Run Simulation
300 sim('Project_4_s')
```

```
301 %Call up next figure
302 fig = figure('OuterPosition',pos_size,'
       PaperPositionMode','auto');
303 fig.Name = 'Elevator Input Simulation';
304 %Changes Paper Print Orientation to landscape on a
       per figure basic
305 orient landscape
306 %Output plots to called figure
307 subplot(3,3,1)
308 plot(time,V_t,'LineWidth',3.0); title({'Total
       Velocity','At Elevator Input'});xlabel('Time (sec
       )');ylabel('Axial Velocity (ft/sec)'); grid on
309 subplot(3,3,2)
310 plot(time,alpha,'LineWidth',3.0); title({'Angle-of-
       Attack','At Elevator Input'});xlabel('Time (sec)'
       );ylabel('Angle-of-Attack (deg)'); grid on
311 subplot(3,3,3)
312 plot(time,beta,'LineWidth',3.0); title({'Sideslip
       Angle','At Elevator Input'});xlabel('Time (sec)')
       ;ylabel('Sideslip Angle (deg)'); grid on
313 subplot(3,3,4)
314 plot(time,p,'LineWidth',3.0); title({'Roll Rate','At
        Elevator Input'});xlabel('Time (sec)');ylabel('
       Roll Rate (deg/sec)'); grid on
315 subplot(3,3,5)
316 plot(time,q,'LineWidth',3.0); title({'Pitch Rate','
       At Elevator Input'});xlabel('Time (sec)');ylabel(
       'Pitch Rate (deg/sec)'); grid on
317 subplot(3,3,6)
318 plot(time,r,'LineWidth',3.0); title({'Yaw Rate','At
       Elevator Input'});xlabel('Time (sec)');ylabel('
       Yaw Rate (deg/sec)'); grid on
319 subplot(3,3,7)
320 plot(time,phi,'LineWidth',3.0); title({'Bank Angle',
       'At Elevator Input'});xlabel('Time (sec)');ylabel
       ('Axial Velocity (deg)'); grid on
321 subplot(3,3,8)
322 plot(time,theta,'LineWidth',3.0); title({'Pitch
```

```
   Angle','At Elevator Input'});xlabel('Time (sec)')
   ;ylabel('Pitch Angle (deg)'); grid on
subplot(3,3,9)
plot(time,psi,'LineWidth',3.0); title({'Heading
   Angle','At Elevator Input'});xlabel('Time (sec)')
   ;ylabel('Heading Angle (deg)'); grid on
% %'Paperposition', [left bottom width height]
  set(fig,'PaperPositionMode', 'manual', 'PaperUnits
    ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
%  print('-P\\meprint2\gle-2120-pr02c',fig)
name = [strrep(fig.Name,' ','_')];
print(fig,'-depsc','-noui','-painters',name);
fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
   fill} Clair Cunningham \\hspace*{\\fill} Problem
   %d}\n',num);
fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
   centering\\includegraphics[keepaspectratio=true,
   height=1\\textheight,width=1\\textwidth,angle
   =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
   end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
   fig.Name);

%Derivative Figure and Plot
fig = figure('OuterPosition',pos_size,'
   PaperPositionMode','auto');
fig.Name = 'Elevator Input Simulation Derivative';
%Changes Paper Print Orientation to landscape on a
   per figure basic
orient landscape
%Output derivative plots to called figure
subplot(3,3,1)
plot(time,V_tdot,'LineWidth',3.0); title({'Total
   Acceleration','At Elevator Input'});xlabel('Time
   (sec)');ylabel('Acceleration (ft^2/sec)'); grid
   on
subplot(3,3,2)
plot(time,alphadot,'LineWidth',3.0); title({'Angle-
   of-Attack Rate','At Elevator Input'});xlabel('
```

```
   Time (sec)');ylabel('Angle-of-Attack Rate (rad^2/
   sec)'); grid on
343 subplot(3,3,3)
344 plot(time,betadot,'LineWidth',3.0); title({'Sideslip
    Angle Rate','At Elevator Input'});xlabel('Time (
   sec)');ylabel('Sideslip Angle Rate (rad/sec)');
   grid on
345 subplot(3,3,4)
346 plot(time,pdot,'LineWidth',3.0); title({'Roll
   Acceleration','At Elevator Input'});xlabel('Time
   (sec)');ylabel('Roll Acceleration (rad^2/sec)');
   grid on
347 subplot(3,3,5)
348 plot(time,qdot,'LineWidth',3.0); title({'Pitch
   Acceleration','At Elevator Input'});xlabel('Time
   (sec)');ylabel('Pitch Acceleration (rad^2/sec)');
    grid on
349 subplot(3,3,6)
350 plot(time,rdot,'LineWidth',3.0); title({'Yaw
   Acceleration','At Elevator Input'});xlabel('Time
   (sec)');ylabel('Yaw Acceleration (rad^2/sec)');
   grid on
351 subplot(3,3,7)
352 plot(time,phidot,'LineWidth',3.0); title({'Bank
   Angle Rate','At Elevator Input'});xlabel('Time (
   sec)');ylabel('Bank Angle Acceleration (rad/sec)'
   ); grid on
353 subplot(3,3,8)
354 plot(time,thetadot,'LineWidth',3.0); title({'Pitch
   Angle Rate','At Elevator Input'});xlabel('Time (
   sec)');ylabel('Pitch Angle Rate (rad/sec)'); grid
    on
355 subplot(3,3,9)
356 plot(time,psidot,'LineWidth',3.0); title({'Heading
   Angle Rate','At Elevator Input'});xlabel('Time (
   sec)');ylabel('Heading Angle Rate (rad/sec)');
   grid on
357 % %'Paperposition', [left bottom width height]
```

```
358   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
        ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
359 %  print('-P\\meprint2\gle-2120-pr02c',fig)
360 % name = [strrep(fig.Name,' ','_')];
361 % print(fig,'-depsc','-noui','-painters',name);
362 % fprintf(fid,'\\sectionmark{Project \\# 4\\hspace
      *{\\fill} Clair Cunningham \\hspace*{\\fill}
      Problem %d}\n',num);
363 % fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
      centering\\includegraphics[keepaspectratio=true,
      height=1\\textheight,width=1\\textwidth,angle
      =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
      end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
      fig.Name);
364
365 %Quaternion Figure and Plot
366 fig = figure('OuterPosition',pos_size,'
      PaperPositionMode','auto');
367 fig.Name = 'Elevator Input Simulation Quaternion
      Model';
368 %Changes Paper Print Orientation to landscape on a
      per figure basic
369 orient landscape
370 %Output Euler Angles Derived from Quaternion Model
371 subplot(2,2,1)
372 plot(time,phi_quat,'LineWidth',3.0); title({'Bank
      Angle Quaternion','At Elevator Input'});xlabel('
      Time (sec)');ylabel('Angle (deg)'); grid on
373 subplot(2,2,2)
374 plot(time,theta_quat,'LineWidth',3.0); title({'Pitch
       Angle Quaternion','At Elevator Input'});xlabel('
      Time (sec)');ylabel('Angle (deg)'); grid on
375 subplot(2,2,3)
376 plot(time,psi_quat,'LineWidth',3.0); title({'Heading
       Angle Quaternion','At Elevator Input'});xlabel('
      Time (sec)');ylabel('Angle (deg)'); grid on
377 % %'Paperposition', [left bottom width height]
378   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
```

```
     ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
%  print('-P\\meprint2\gle-2120-pr02c',fig)
name = [strrep(fig.Name,' ','_')];
print(fig,'-depsc','-noui','-painters',name);
fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
   fill} Clair Cunningham \\hspace*{\\fill} Problem
   %d}\n',num);
fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
   centering\\includegraphics[keepaspectratio=true,
   height=1\\textheight,width=1\\textwidth,angle
   =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
   end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
   fig.Name);
%% Aileron Input Simulation
num = num + 1;
%Inputs to Elevator, Aileron, or Rudder
    % Degs
    de_d = 0;
    da_d = -0.5;
    df_d = 0;
    dr_d = 0; % deg
    % Radians
    de = de_d*d2r;
    da = da_d*d2r;
    df = df_d*d2r;
    dr = dr_d*d2r;

%Run Simulation
sim('Project_4_s')
%Call up next figure
fig = figure('OuterPosition',pos_size,'
   PaperPositionMode','auto');
fig.Name = 'Aileron Input Simulation';
%Changes Paper Print Orientation to landscape on a
   per figure basic
orient landscape
%Output plots to called figure
subplot(3,3,1)
```

```
407 plot(time,V_t,'LineWidth',3.0); title({'Total
       Velocity','At Aileron Input'});xlabel('Time (sec)
       ');ylabel('Axial Velocity (ft/sec)'); grid on
408 subplot(3,3,2)
409 plot(time,alpha,'LineWidth',3.0); title({'Angle-of-
       Attack','At Aileron Input'});xlabel('Time (sec)')
       ;ylabel('Angle-of-Attack (deg)'); grid on
410 subplot(3,3,3)
411 plot(time,beta,'LineWidth',3.0); title({'Sideslip
       Angle','At Aileron Input'});xlabel('Time (sec)');
       ylabel('Sideslip Angle (deg)'); grid on
412 subplot(3,3,4)
413 plot(time,p,'LineWidth',3.0); title({'Roll Rate','At
        Aileron Input'});xlabel('Time (sec)');ylabel('
       Roll Rate (deg/sec)'); grid on
414 subplot(3,3,5)
415 plot(time,q,'LineWidth',3.0); title({'Pitch Rate','
       At Aileron Input'});xlabel('Time (sec)');ylabel('
       Pitch Rate (deg/sec)'); grid on
416 subplot(3,3,6)
417 plot(time,r,'LineWidth',3.0); title({'Yaw Rate','At
       Aileron Input'});xlabel('Time (sec)');ylabel('Yaw
        Rate (deg/sec)'); grid on
418 subplot(3,3,7)
419 plot(time,phi,'LineWidth',3.0); title({'Bank Angle',
       'At Aileron Input'});xlabel('Time (sec)');ylabel(
       'Axial Velocity (deg)'); grid on
420 subplot(3,3,8)
421 plot(time,theta,'LineWidth',3.0); title({'Pitch
       Angle','At Aileron Input'});xlabel('Time (sec)');
       ylabel('Pitch Angle (deg)'); grid on
422 subplot(3,3,9)
423 plot(time,psi,'LineWidth',3.0); title({'Heading
       Angle','At Aileron Input'});xlabel('Time (sec)');
       ylabel('Heading Angle (deg)'); grid on
424 % %'Paperposition', [left bottom width height]
425   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
        ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
```

```
426 %  print('-P\\meprint2\gle-2120-pr02c',fig)
427 name = [strrep(fig.Name,' ','_')];
428 print(fig,'-depsc','-noui','-painters',name);
429 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
      fill} Clair Cunningham \\hspace*{\\fill} Problem
      %d}\n',num);
430 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
      centering\\includegraphics[keepaspectratio=true,
      height=1\\textheight,width=1\\textwidth,angle
      =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
      end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
      fig.Name);
431
432 %Derivative Figure and Plot
433 fig = figure('OuterPosition',pos_size,'
      PaperPositionMode','auto');
434 fig.Name = 'Aileron Input Simulation Derivative';
435 %Changes Paper Print Orientation to landscape on a
      per figure basic
436 orient landscape
437 %Output derivative plots to called figure
438 subplot(3,3,1)
439 plot(time,V_tdot,'LineWidth',3.0); title({'Total
      Acceleration','At Aileron Input'});xlabel('Time (
      sec)');ylabel('Acceleration (ft^2/sec)'); grid on
440 subplot(3,3,2)
441 plot(time,alphadot,'LineWidth',3.0); title({'Angle-
      of-Attack Rate','At Aileron Input'});xlabel('Time
       (sec)');ylabel('Angle-of-Attack Rate (rad^2/sec)
      '); grid on
442 subplot(3,3,3)
443 plot(time,betadot,'LineWidth',3.0); title({'Sideslip
       Angle Rate','At Aileron Input'});xlabel('Time (
      sec)');ylabel('Sideslip Angle Rate (rad/sec)');
      grid on
444 subplot(3,3,4)
445 plot(time,pdot,'LineWidth',3.0); title({'Roll
      Acceleration','At Aileron Input'});xlabel('Time (
```

```
   sec)');ylabel('Roll Acceleration (rad^2/sec)');
   grid on
446 subplot(3,3,5)
447 plot(time,qdot,'LineWidth',3.0); title({'Pitch
   Acceleration','At Aileron Input'});xlabel('Time (
   sec)');ylabel('Pitch Acceleration (rad^2/sec)');
   grid on
448 subplot(3,3,6)
449 plot(time,rdot,'LineWidth',3.0); title({'Yaw
   Acceleration','At Aileron Input'});xlabel('Time (
   sec)');ylabel('Yaw Acceleration (rad^2/sec)');
   grid on
450 subplot(3,3,7)
451 plot(time,phidot,'LineWidth',3.0); title({'Bank
   Angle Rate','At Aileron Input'});xlabel('Time (
   sec)');ylabel('Bank Angle Acceleration (rad/sec)'
   ); grid on
452 subplot(3,3,8)
453 plot(time,thetadot,'LineWidth',3.0); title({'Pitch
   Angle Rate','At Aileron Input'});xlabel('Time (
   sec)');ylabel('Pitch Angle Rate (rad/sec)'); grid
    on
454 subplot(3,3,9)
455 plot(time,psidot,'LineWidth',3.0); title({'Heading
   Angle Rate','At Aileron Input'});xlabel('Time (
   sec)');ylabel('Heading Angle Rate (rad/sec)');
   grid on
456 % %'Paperposition', [left bottom width height]
457   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
      ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
458 %  print('-P\\meprint2\gle-2120-pr02c',fig)
459 name = [strrep(fig.Name,' ','_')];
460 print(fig,'-depsc','-noui','-painters',name);
461 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
   fill} Clair Cunningham \\hspace*{\\fill} Problem
   %d}\n',num);
462 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
   centering\\includegraphics[keepaspectratio=true,
```

```
    height=1\\textheight,width=1\\textwidth,angle
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
463
464 %Quaternion Figure and Plot
465 fig = figure('OuterPosition',pos_size,'
    PaperPositionMode','auto');
466 fig.Name = 'Aileron Input Simulation Quaternion
    Model';
467 %Changes Paper Print Orientation to landscape on a
    per figure basic
468 orient landscape
469 %Output Euler Angles Derived from Quaternion Model
470 subplot(2,2,1)
471 plot(time,phi_quat,'LineWidth',3.0); title({'Bank
    Angle Quaternion','At Aileron Input'});xlabel('
    Time (sec)');ylabel('Angle (deg)'); grid on
472 subplot(2,2,2)
473 plot(time,theta_quat,'LineWidth',3.0); title({'Pitch
     Angle Quaternion','At Aileron Input'});xlabel('
    Time (sec)');ylabel('Angle (deg)'); grid on
474 subplot(2,2,3)
475 plot(time,psi_quat,'LineWidth',3.0); title({'Heading
     Angle Quaternion','At Aileron Input'});xlabel('
    Time (sec)');ylabel('Angle (deg)'); grid on
476 % %'Paperposition', [left bottom width height]
477   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
      ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
478 %  print('-P\\meprint2\gle-2120-pr02c',fig)
479 name = [strrep(fig.Name,' ','_')];
480 print(fig,'-depsc','-noui','-painters',name);
481 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
    fill} Clair Cunningham \\hspace*{\\fill} Problem
    %d}\n',num);
482 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
    centering\\includegraphics[keepaspectratio=true,
    height=1\\textheight,width=1\\textwidth,angle
```

```
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
483
484 % %% Flap Input Simulation
485 % num = num + 1;
486 % %Inputs to Elevator, Aileron, or Rudder
487 %     % Degs
488 %     de_d = 0;
489 %     da_d = 0;
490 %     df_d = 0;
491 %     dr_d = 0;
492 %     % Radians
493 %     de = de_d*d2r;
494 %     da = da_d*d2r;
495 %     df = df_d*d2r;
496 %     dr = dr_d*d2r;
497 %
498 % %Run Simulation
499 % sim('Project_4_s')
500 % %Call up next figure
501 % fig = figure('OuterPosition',pos_size,'
    PaperPositionMode','auto');
502 % fig.Name = 'Flap Input Simulation';
503 % %Changes Paper Print Orientation to landscape on a
      per figure basic
504 % orient landscape
505 % %Output plots to called figure
506 % subplot(3,3,1)
507 % plot(time,V_t,'LineWidth',3.0); title({'Total
    Velocity','At Flap Input'});xlabel('Time (sec)');
    ylabel('Axial Velocity (ft/sec)'); grid on
508 % subplot(3,3,2)
509 % plot(time,alpha,'LineWidth',3.0); title({'Angle-of
    -Attack','At Flap Input'});xlabel('Time (sec)');
    ylabel('Angle-of-Attack (deg)'); grid on
510 % subplot(3,3,3)
511 % plot(time,beta,'LineWidth',3.0); title({'Sideslip
```

```
   Angle','At Flap Input'});xlabel('Time (sec)');
   ylabel('Sideslip Angle (deg)'); grid on
% subplot(3,3,4)
% plot(time,p,'LineWidth',3.0); title({'Roll Rate','
   At Flap Input'});xlabel('Time (sec)');ylabel('
   Roll Rate (deg/sec)'); grid on
% subplot(3,3,5)
% plot(time,q,'LineWidth',3.0); title({'Pitch Rate
   ','At Flap Input'});xlabel('Time (sec)');ylabel('
   Pitch Rate (deg/sec)'); grid on
% subplot(3,3,6)
% plot(time,r,'LineWidth',3.0); title({'Yaw Rate','
   At Flap Input'});xlabel('Time (sec)');ylabel('Yaw
    Rate (deg/sec)'); grid on
% subplot(3,3,7)
% plot(time,phi,'LineWidth',3.0); title({'Bank Angle
   ','At Flap Input'});xlabel('Time (sec)');ylabel('
   Axial Velocity (deg)'); grid on
% subplot(3,3,8)
% plot(time,theta,'LineWidth',3.0); title({'Pitch
   Angle','At Flap Input'});xlabel('Time (sec)');
   ylabel('Pitch Angle (deg)'); grid on
% subplot(3,3,9)
% plot(time,psi,'LineWidth',3.0); title({'Heading
   Angle','At Flap Input'});xlabel('Time (sec)');
   ylabel('Heading Angle (deg)'); grid on
% % %'Paperposition', [left bottom width height]
% set(fig,'PaperPositionMode', 'manual', 'PaperUnits
   ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
% %  print('-P\\meprint2\gle-2120-pr02c',fig)
% name = [strrep(fig.Name,' ','_')];
% print(fig,'-depsc','-noui','-painters',name);
% fprintf(fid,'\\sectionmark{Project \\# 4\\hspace
   *{\\fill} Clair Cunningham \\hspace*{\\fill}
   Problem %d}\n',num);
% fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
   centering\\includegraphics[keepaspectratio=true,
   height=1\\textheight,width=1\\textwidth,angle
```

```
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
531 %
532 % %Derivative Figure and Plot
533 % fig = figure('OuterPosition',pos_size,'
    PaperPositionMode','auto');
534 % fig.Name = 'Flap Input Simulation Derivative';
535 % %Changes Paper Print Orientation to landscape on a
     per figure basic
536 % orient landscape
537 % %Output derivative plots to called figure
538 % subplot(3,3,1)
539 % plot(time,V_tdot,'LineWidth',3.0); title({'Total
    Acceleration','At Flap Input'});xlabel('Time (sec
    )');ylabel('Acceleration (ft^2/sec)'); grid on
540 % subplot(3,3,2)
541 % plot(time,alphadot,'LineWidth',3.0); title({'Angle
    -of-Attack Rate','At Flap Input'});xlabel('Time (
    sec)');ylabel('Angle-of-Attack Rate (rad^2/sec)')
    ; grid on
542 % subplot(3,3,3)
543 % plot(time,betadot,'LineWidth',3.0); title({'
    Sideslip Angle Rate','At Flap Input'});xlabel('
    Time (sec)');ylabel('Sideslip Angle Rate (rad/sec
    )'); grid on
544 % subplot(3,3,4)
545 % plot(time,pdot,'LineWidth',3.0); title({'Roll
    Acceleration','At Flap Input'});xlabel('Time (sec
    )');ylabel('Roll Acceleration (rad^2/sec)'); grid
     on
546 % subplot(3,3,5)
547 % plot(time,qdot,'LineWidth',3.0); title({'Pitch
    Acceleration','At Flap Input'});xlabel('Time (sec
    )');ylabel('Pitch Acceleration (rad^2/sec)');
    grid on
548 % subplot(3,3,6)
549 % plot(time,rdot,'LineWidth',3.0); title({'Yaw
```

```
    Acceleration','At Flap Input'});xlabel('Time (sec
    )');ylabel('Yaw Acceleration (rad^2/sec)'); grid
    on
% subplot(3,3,7)
% plot(time,phidot,'LineWidth',3.0); title({'Bank
    Angle Rate','At Flap Input'});xlabel('Time (sec)
    ');ylabel('Bank Angle Acceleration (rad/sec)');
    grid on
% subplot(3,3,8)
% plot(time,thetadot,'LineWidth',3.0); title({'Pitch
     Angle Rate','At Flap Input'});xlabel('Time (sec)
    ');ylabel('Pitch Angle Rate (rad/sec)'); grid on
% subplot(3,3,9)
% plot(time,psidot,'LineWidth',3.0); title({'Heading
     Angle Rate','At Flap Input'});xlabel('Time (sec)
    ');ylabel('Heading Angle Rate (rad/sec)'); grid
    on
% %'Paperposition', [left bottom width height]
%  set(fig,'PaperPositionMode', 'manual', '
    PaperUnits','Inches', 'Paperposition',[0.0 0.0 11
     8.5])
% %  print('-P\\meprint2\gle-2120-pr02c',fig)
% name = [strrep(fig.Name,' ','_')];
% print(fig,'-depsc','-noui','-painters',name);
% fprintf(fid,'\\sectionmark{Project \\# 4\\hspace
    *{\\fill} Clair Cunningham \\hspace*{\\fill}
    Problem %d}\n',num);
% fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
    centering\\includegraphics[keepaspectratio=true,
    height=1\\textheight,width=1\\textwidth,angle
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
%
% %Quaternion Figure and Plot
% fig = figure('OuterPosition',pos_size,'
    PaperPositionMode','auto');
% fig.Name = 'Flap Input Simulation Quaternion Model
```

```
    ';
% %Changes Paper Print Orientation to landscape on a per figure basic
% orient landscape
% %Output Euler Angles Derived from Quaternion Model
% subplot(2,2,1)
% plot(time,phi_quat,'LineWidth',3.0); title({'Bank Angle Quaternion','At Flap Input'});xlabel('Time (sec)');ylabel('Angle (deg)'); grid on
% subplot(2,2,2)
% plot(time,theta_quat,'LineWidth',3.0); title({'Pitch Angle Quaternion','At Flap Input'});xlabel('Time (sec)');ylabel('Angle (deg)'); grid on
% subplot(2,2,3)
% plot(time,psi_quat,'LineWidth',3.0); title({'Heading Angle Quaternion','At Flap Input'}); xlabel('Time (sec)');ylabel('Angle (deg)'); grid on
% % %'Paperposition', [left bottom width height]
% %  set(fig,'PaperPositionMode', 'manual', 'PaperUnits','Inches', 'Paperposition',[0.0 0.0 11 8.5])
% %  print('-P\\meprint2\gle-2120-pr02c',fig)
% name = [strrep(fig.Name,' ','_')];
% print(fig,'-depsc','-noui','-painters',name);
% fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\fill} Clair Cunningham \\hspace*{\\fill} Problem %d}\n',num);
% fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\centering\\includegraphics[keepaspectratio=true,height=1\\textheight,width=1\\textwidth,angle=90]{%s.eps}\n \\caption{%s Graphical Solution}\\end{figure}\\vspace*{\\fill}\n\\newpage\n',name,fig.Name);
%% Rudder Input Simulation
num = num +1;
%Inputs to Elevator, Aileron, or Rudder
    % Degs
```

```
587      de_d = 0;
588      da_d = 0;
589      df_d = 0;
590      dr_d = -2.0; % deg
591      % Radians
592      de = de_d*d2r;
593      da = da_d*d2r;
594      df = df_d*d2r;
595      dr = dr_d*d2r;
596
597  %Run Simulation
598  sim('Project_4_s')
599  %Call up next figure
600  fig = figure('OuterPosition',pos_size,'
        PaperPositionMode','auto');
601  fig.Name = 'Rudder Input Simulation';
602  %Changes Paper Print Orientation to landscape on a
        per figure basic
603  orient landscape
604  %Output plots to called figure
605  subplot(3,3,1)
606  plot(time,V_t,'LineWidth',3.0); title({'Total
        Velocity','At Rudder Input'});xlabel('Time (sec)'
        );ylabel('Axial Velocity (ft/sec)'); grid on
607  subplot(3,3,2)
608  plot(time,alpha,'LineWidth',3.0); title({'Angle-of-
        Attack','At Rudder Input'});xlabel('Time (sec)');
        ylabel('Angle-of-Attack (deg)'); grid on
609  subplot(3,3,3)
610  plot(time,beta,'LineWidth',3.0); title({'Sideslip
        Angle','At Rudder Input'});xlabel('Time (sec)');
        ylabel('Sideslip Angle (deg)'); grid on
611  subplot(3,3,4)
612  plot(time,p,'LineWidth',3.0); title({'Roll Rate','At
         Rudder Input'});xlabel('Time (sec)');ylabel('
        Roll Rate (deg/sec)'); grid on
613  subplot(3,3,5)
614  plot(time,q,'LineWidth',3.0); title({'Pitch Rate','
```

```
    At Rudder Input'});xlabel('Time (sec)');ylabel('
    Pitch Rate (deg/sec)'); grid on
615 subplot(3,3,6)
616 plot(time,r,'LineWidth',3.0); title({'Yaw Rate','At
    Rudder Input'});xlabel('Time (sec)');ylabel('Yaw
    Rate (deg/sec)'); grid on
617 subplot(3,3,7)
618 plot(time,phi,'LineWidth',3.0); title({'Bank Angle',
    'At Rudder Input'});xlabel('Time (sec)');ylabel('
    Axial Velocity (deg)'); grid on
619 subplot(3,3,8)
620 plot(time,theta,'LineWidth',3.0); title({'Pitch
    Angle','At Rudder Input'});xlabel('Time (sec)');
    ylabel('Pitch Angle (deg)'); grid on
621 subplot(3,3,9)
622 plot(time,psi,'LineWidth',3.0); title({'Heading
    Angle','At Rudder Input'});xlabel('Time (sec)');
    ylabel('Heading Angle (deg)'); grid on
623 % %'Paperposition', [left bottom width height]
624   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
      ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
625 %  print('-P\\meprint2\gle-2120-pr02c',fig)
626 name = [strrep(fig.Name,' ','_')];
627 print(fig,'-depsc','-noui','-painters',name);
628 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
    fill} Clair Cunningham \\hspace*{\\fill} Problem
    %d}\n',num);
629 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
    centering\\includegraphics[keepaspectratio=true,
    height=1\\textheight,width=1\\textwidth,angle
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
630
631 %Derivative Figure and Plot
632 fig = figure('OuterPosition',pos_size,'
    PaperPositionMode','auto');
633 fig.Name = 'Rudder Input Simulation Derivative';
```

```
634 %Changes Paper Print Orientation to landscape on a
       per figure basic
635 orient landscape
636 %Output derivative plots to called figure
637 subplot(3,3,1)
638 plot(time,V_tdot,'LineWidth',3.0); title({'Total
       Acceleration','At Rudder Input'});xlabel('Time (
       sec)');ylabel('Acceleration (ft^2/sec)'); grid on
639 subplot(3,3,2)
640 plot(time,alphadot,'LineWidth',3.0); title({'Angle-
       of-Attack Rate','At Rudder Input'});xlabel('Time
       (sec)');ylabel('Angle-of-Attack Rate (rad^2/sec)'
       ); grid on
641 subplot(3,3,3)
642 plot(time,betadot,'LineWidth',3.0); title({'Sideslip
        Angle Rate','At Rudder Input'});xlabel('Time (
       sec)');ylabel('Sideslip Angle Rate (rad/sec)');
       grid on
643 subplot(3,3,4)
644 plot(time,pdot,'LineWidth',3.0); title({'Roll
       Acceleration','At Rudder Input'});xlabel('Time (
       sec)');ylabel('Roll Acceleration (rad^2/sec)');
       grid on
645 subplot(3,3,5)
646 plot(time,qdot,'LineWidth',3.0); title({'Pitch
       Acceleration','At Rudder Input'});xlabel('Time (
       sec)');ylabel('Pitch Acceleration (rad^2/sec)');
       grid on
647 subplot(3,3,6)
648 plot(time,rdot,'LineWidth',3.0); title({'Yaw
       Acceleration','At Rudder Input'});xlabel('Time (
       sec)');ylabel('Yaw Acceleration (rad^2/sec)');
       grid on
649 subplot(3,3,7)
650 plot(time,phidot,'LineWidth',3.0); title({'Bank
       Angle Rate','At Rudder Input'});xlabel('Time (sec
       )');ylabel('Bank Angle Acceleration (rad/sec)');
       grid on
```

```
651 subplot(3,3,8)
652 plot(time,thetadot,'LineWidth',3.0); title({'Pitch
       Angle Rate','At Rudder Input'});xlabel('Time (sec
       )');ylabel('Pitch Angle Rate (rad/sec)'); grid on
653 subplot(3,3,9)
654 plot(time,psidot,'LineWidth',3.0); title({'Heading
       Angle Rate','At Rudder Input'});xlabel('Time (sec
       )');ylabel('Heading Angle Rate (rad/sec)'); grid
       on
655 % %'Paperposition', [left bottom width height]
656   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
         ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
657 %  print('-P\\meprint2\gle-2120-pr02c',fig)
658 % name = [strrep(fig.Name,' ','_')];
659 % print(fig,'-depsc','-noui','-painters',name);
660 % fprintf(fid,'\\sectionmark{Project \\# 4\\hspace
       *{\\fill} Clair Cunningham \\hspace*{\\fill}
       Problem %d}\n',num);
661 % fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
       centering\\includegraphics[keepaspectratio=true,
       height=1\\textheight,width=1\\textwidth,angle
       =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
       end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
       fig.Name);
662
663 %Quaternion Figure and Plot
664 fig = figure('OuterPosition',pos_size,'
       PaperPositionMode','auto');
665 fig.Name = 'Rudder Input Simulation Quaternion Model
       ';
666 %Changes Paper Print Orientation to landscape on a
       per figure basic
667 orient landscape
668 %Output Euler Angles Derived from Quaternion Model
669 subplot(2,2,1)
670 plot(time,phi_quat,'LineWidth',3.0); title({'Bank
       Angle Quaternion','At Rudder Input'});xlabel('
       Time (sec)');ylabel('Angle (deg)'); grid on
```

```
671 subplot(2,2,2)
672 plot(time,theta_quat,'LineWidth',3.0); title({'Pitch
        Angle Quaternion','At Rudder Input'});xlabel('
    Time (sec)');ylabel('Angle (deg)'); grid on
673 subplot(2,2,3)
674 plot(time,psi_quat,'LineWidth',3.0); title({'Heading
        Angle Quaternion','At Rudder Input'});xlabel('
    Time (sec)');ylabel('Angle (deg)'); grid on
675
676 % %'Paperposition', [left bottom width height]
677   set(fig,'PaperPositionMode', 'manual', 'PaperUnits
        ','Inches', 'Paperposition',[0.0 0.0 11 8.5])
678 %  print('-P\\meprint2\gle-2120-pr02c',fig)
679  name = [strrep(fig.Name,' ','_')];
680 print(fig,'-depsc','-noui','-painters',name);
681 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
    fill} Clair Cunningham \\hspace*{\\fill} Problem
    %d}\n',num);
682 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
    centering\\includegraphics[keepaspectratio=true,
    height=1\\textheight,width=1\\textwidth,angle
    =90]{%s.eps}\n \\caption{%s Graphical Solution}\\
    end{figure}\\vspace*{\\fill}\n\\newpage\n',name,
    fig.Name);
683
684 %% End of File Commands
685 name = 'Project_4_s';
686 load_system(name);
687 %modelhandle = get_param('name', 'Handle')
688 handles = find_system(name, 'FindAll', 'On', '
    SearchDepth', 10, ...
689     'regexp', 'on', 'blocktype', 'port');
690 list = get(handles,'Path');
691 if ~iscell(list)
692     list = {list};
693 end
694 list = unique(list);
695 if ~iscell(handles)
```

```
696     handle = {handles};
697 end
698 % add main model
699 list{end+1} = name;
700 % GEt only last part of path, that is, after the
    last /
701 [r1, r2] = regexpi(list, '[^/]+$', 'tokens', 'match'
    );
702
703 % Convert to usable format
704 names = [r2{:}]';
705
706 % Cells of printNames.
707 % Just rename every non-alphanumeric char to _, all
    space to ''
708 printNames = regexprep(names', {'\s', '\W'}, {'', '_
    '});
709
710 for i = 1 : length(list)
711     item = char(list(i));
712 modelhandle = get_param(item, 'Handle');
713 set(modelhandle,'PaperPositionMode', 'manual', '
    PaperUnits','Inches', 'Paperposition',[0.0 0.0 11
     8.5])
714 print(['-s' item],'-depsc','-noui','-painters',
    printNames{i});
715 fprintf(fid,'\\sectionmark{Project \\# 4\\hspace*{\\
    fill} Clair Cunningham \\hspace*{\\fill} %s}\n',
    strrep(printNames{i},'_','\_'));
716 fprintf(fid,'\\vspace*{\\fill}\\begin{figure}[H]\\
    centering\\includegraphics[keepaspectratio=true,
    height=1\\textheight,width=1\\textwidth,angle
    =90]{%s.eps}\n \\caption{Simulink Diagram}\\end{
    figure}\\vspace*{\\fill}\n\\newpage\n',printNames
    {i});
717 end
718 fclose(fid);
```