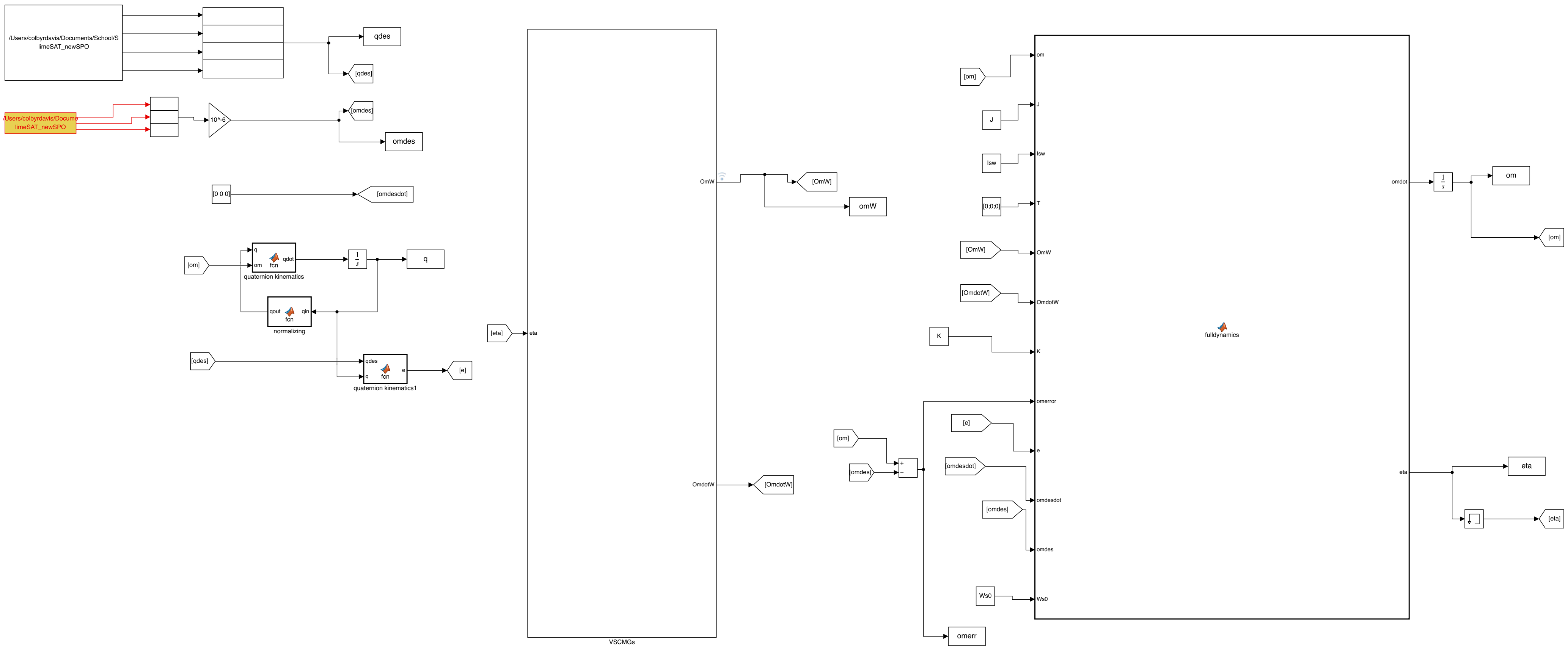
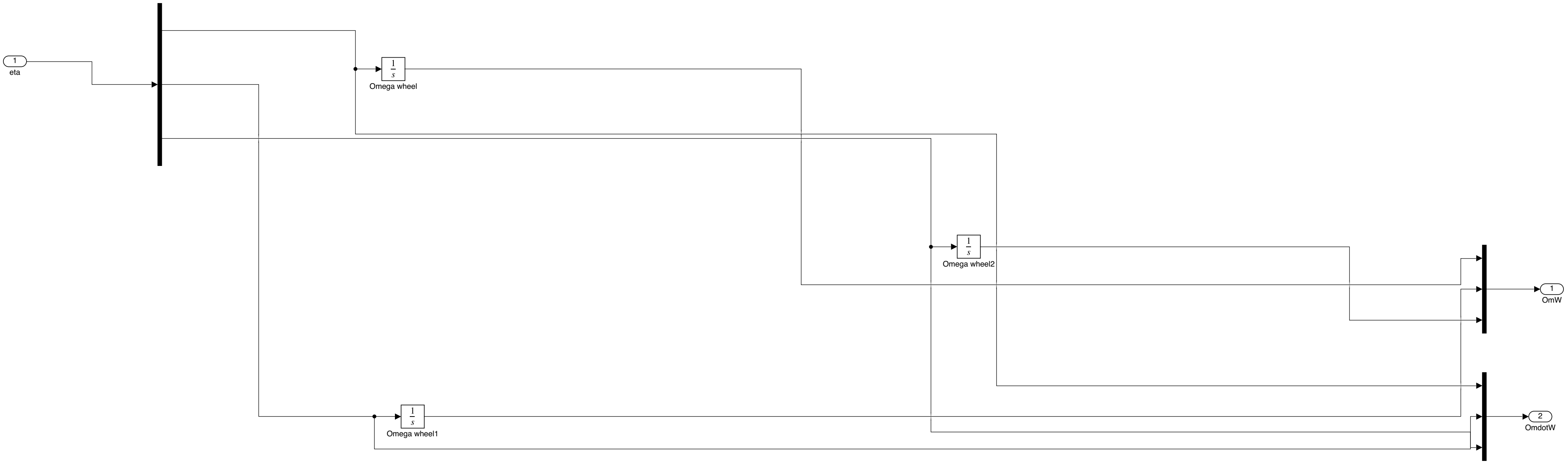

/Users/colbyrdavis/Documents/School/S
limeSAT_newSPO
qdes
[qdes]
/Users/colbyrdavis/Docume
limeSAT_newSPO
10^-6
[omdes]
omdes
[0 0 0]
[omdesdot]
[om]
q
om
fcn
qdot
quaternion kinematics
1/s
q
qout
fcn
qin
normalizing
[qdes]
qdes
q
fcn
e
quaternion kinematics1
[e]
[eta]
eta
OmW
OmdotW
VSCMGs
[OmW]
omW
[OmdotW]
[om]
om
J
J
Isw
Isw
[0;0;0]
T
[OmW]
OmW
[OmdotW]
OmdotW
K
K
omerror
[e]
e
[om]
[omdes]
+
−
[omdesdot]
omdesdot
[omdes]
omdes
Ws0
Ws0
omerr
fulldynamics
omdot
eta
1/s
om
[om]
eta
[eta]

```
function [omdot, eta] = fulldynamics(om, J, Isw, T, OmW, OmdotW, ...
                     K, omerror, e, ...
                     omdesdot, omdes, Ws0)

%initializes output
eta = [0; 0; 0];

%equations of motion with RWs
omdot = J\(-Isw*OmdotW(1)*[1;0;0]-Isw*OmdotW(2)*[0; 1; 0]-Isw*OmdotW(3)*[0; 0; 1] ...
                                           -cross(om, (J)*om) ...
                                           -Isw*OmW(1)*cross(om, [1;0;0]) -Isw*OmW(2)*cross(om, [0;1;0])...
                                           -Isw*OmW(3)*cross(om, [0;0;1]) + T);
%auxiliary matrix
D = [[1;0;0], [0;1;0], [0;0;1]]*diag([Isw;Isw;Isw]);

%required torque to track attitude and its rates according to Lyapunov stability
Tmed = T + K*omerror + e - cross(om,  ((J)*om + Isw*OmW(1)*[1;0;0] + Isw*OmW(2)*[0;1;0] + + Isw*OmW(3)*[0;0;1])) + ...
        - (J)*omdesdot;


%weight matrix for wheels
W = [Ws0 0 0;
     0 Ws0 0;
     0 0 Ws0];

%control variable (wheels' accelerations) solved as a minimization problem
%where we want to generate Tmed with the lowest possible wheels'
%accelerations
eta = W*D'*((D*W*D')\Tmed);
```


1
eta
1/s
Omega wheel
1/s
Omega wheel2
1
OmW
1/s
Omega wheel1
2
OmdotW

```
function e = fcn(qdes, q)
%#codegen

e = [qdes(4) -qdes(3) qdes(2);...
     qdes(3) qdes(4) -qdes(1);...
     -qdes(2) qdes(1) qdes(4);
     -qdes(1) -qdes(2) -qdes(3)]'*q;
```

```
function qout = fcn(qin)
%#codegen

qout = qin/norm(qin);
```

```
function qdot = fcn(q, om)
%#codegen

qdot = (1/2)*[q(4) -q(3) q(2) q(1);...
              q(3) q(4) -q(1) q(2);...
              -q(2) q(1) q(4) q(3);
              -q(1) -q(2) -q(3) q(4)]*[om; 0];
```