Calculating the F control force the inverse of the rotation matrix is required

$R^{-1} = R^T$

$m\ddot{\xi} + m[0\ 0\ g]^T = R \cdot f$

$U_1 = R^T(m\ddot{\xi}_{ref} + m[0\ 0\ g]^T)$ last row of it

X_ref

Y_ref

Z_ref

eta   Rm

R

Position controller

m

m*g

Matrix Multiply

Psi_ref

1
2
3
4
5
6

Non holonomic constrains

1   Phi

psi   Theta

Attitude controller

System

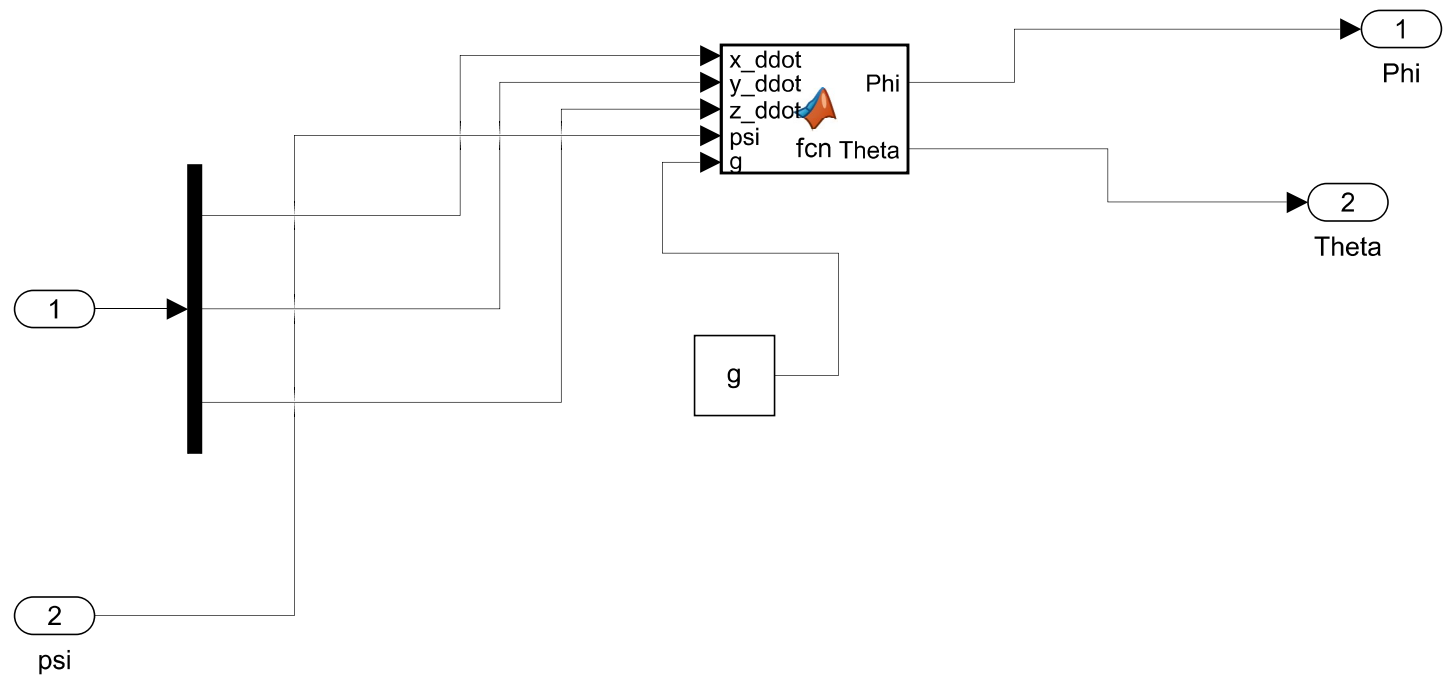I use the measured psi as an input

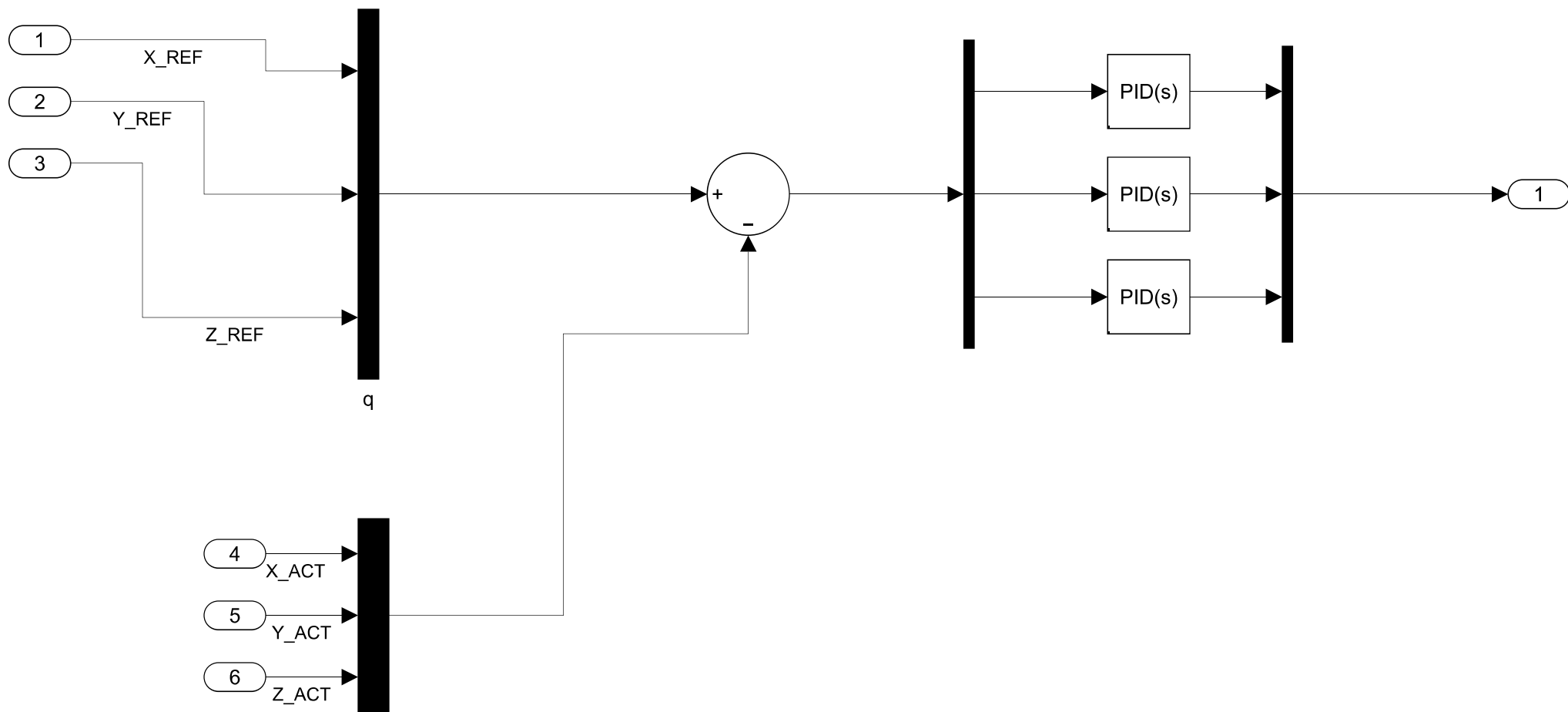atan2 intead of atan

```
function Rm = R(eta)

phi = eta(1);
theta = eta(2);
psi = eta(3);

Rx = [1 0 0; 0 cos(phi) -sin(phi); 0 sin(phi) cos(phi)];
Ry = [cos(theta) 0 sin(theta); 0 1 0; -sin(theta) 0 cos(theta)];
Rz = [cos(psi) -sin(psi) 0; sin(psi) cos(psi) 0; 0 0 1];
Rm = (Rz*Ry*Rx)';
```
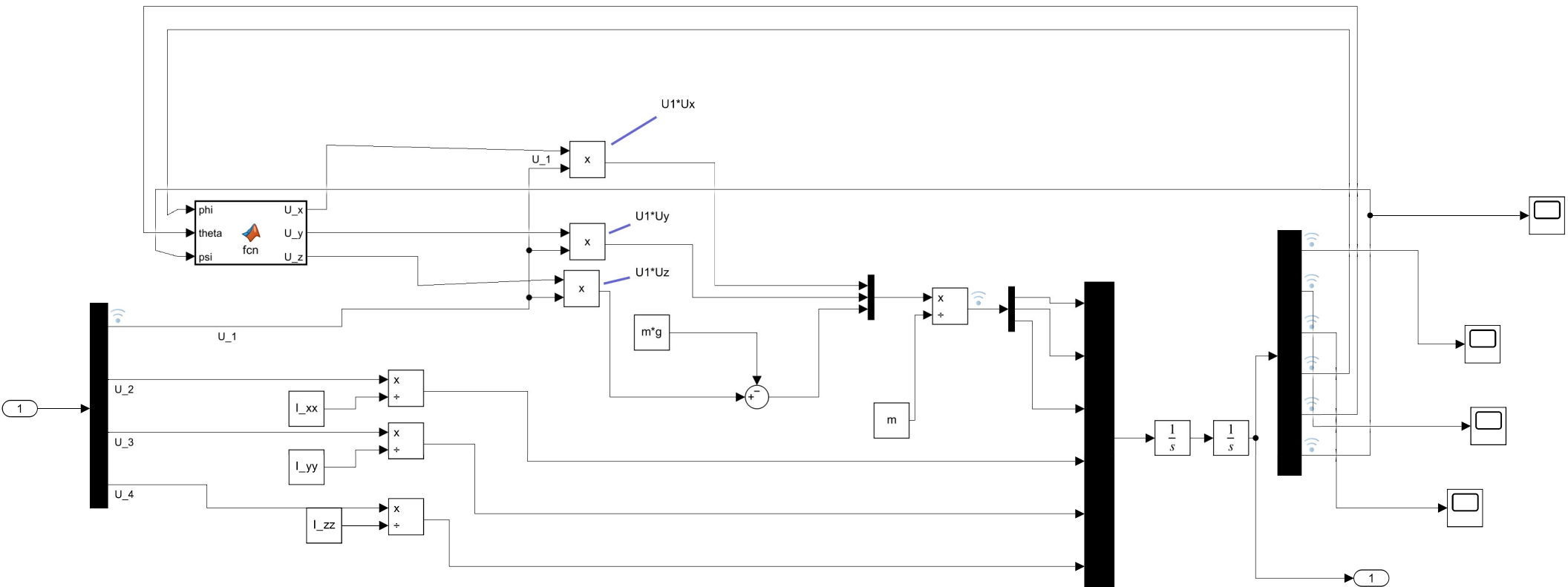
```
function [Phi, Theta] = fcn(x_ddot,y_ddot,z_ddot,psi,g)


Phi = asin((x_ddot*sin(psi)-y_ddot*cos(psi))/(sqrt(x_ddot^2+y_ddot^2+(z_ddot+g)^2)));
Theta =atan2((x_ddot*cos(psi )+y_ddot*sin(psi)),(z_ddot+g));
```

```
function [U_x,U_y,U_z] = fcn(phi,theta,psi)


U_x = cos(phi)*sin(theta)*cos(psi)+sin(phi)*sin(psi);
U_y = cos(phi)*sin(theta)*sin(psi)-sin(phi)*cos(psi);
U_z =cos(phi)*cos(theta);
```