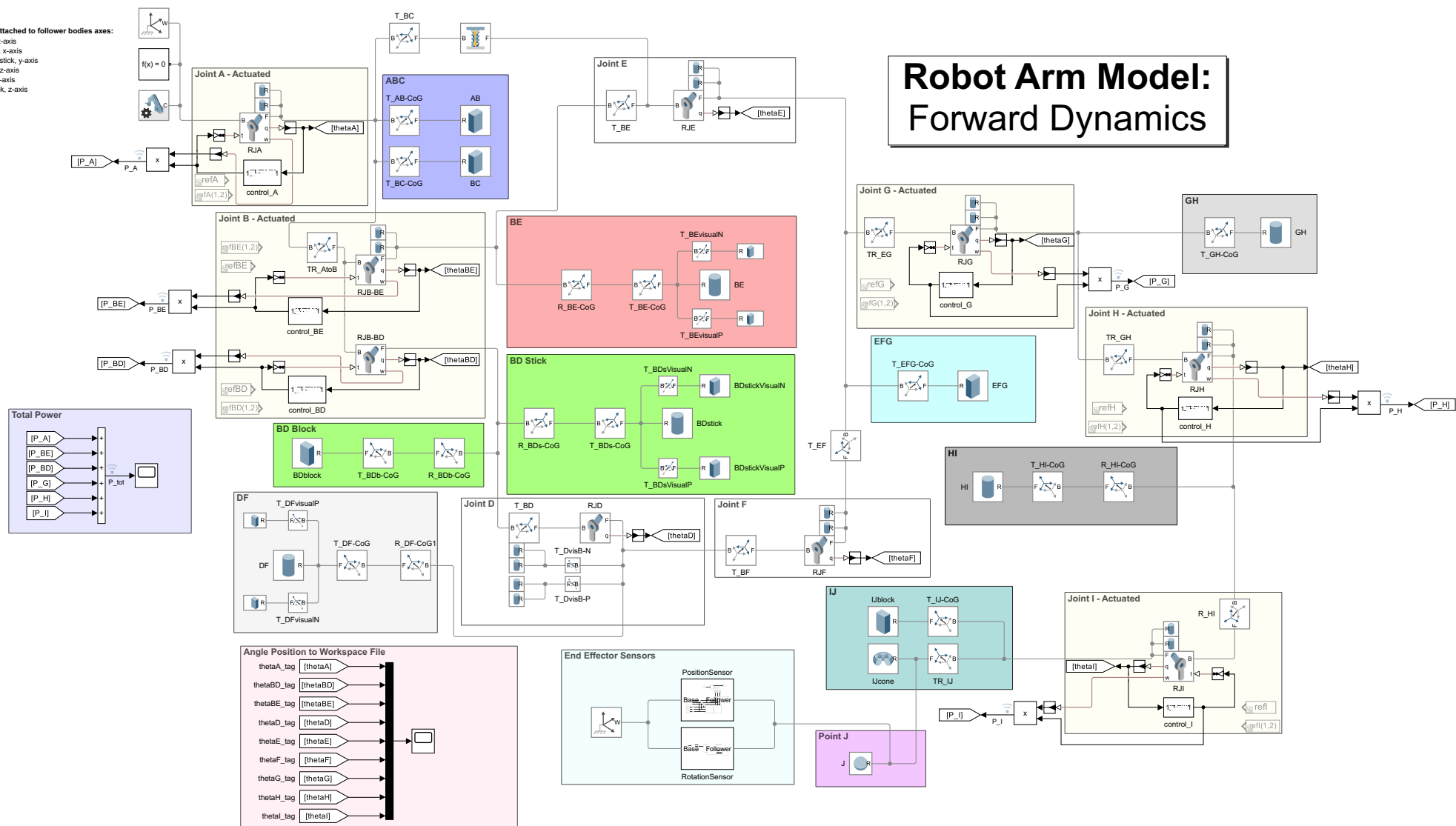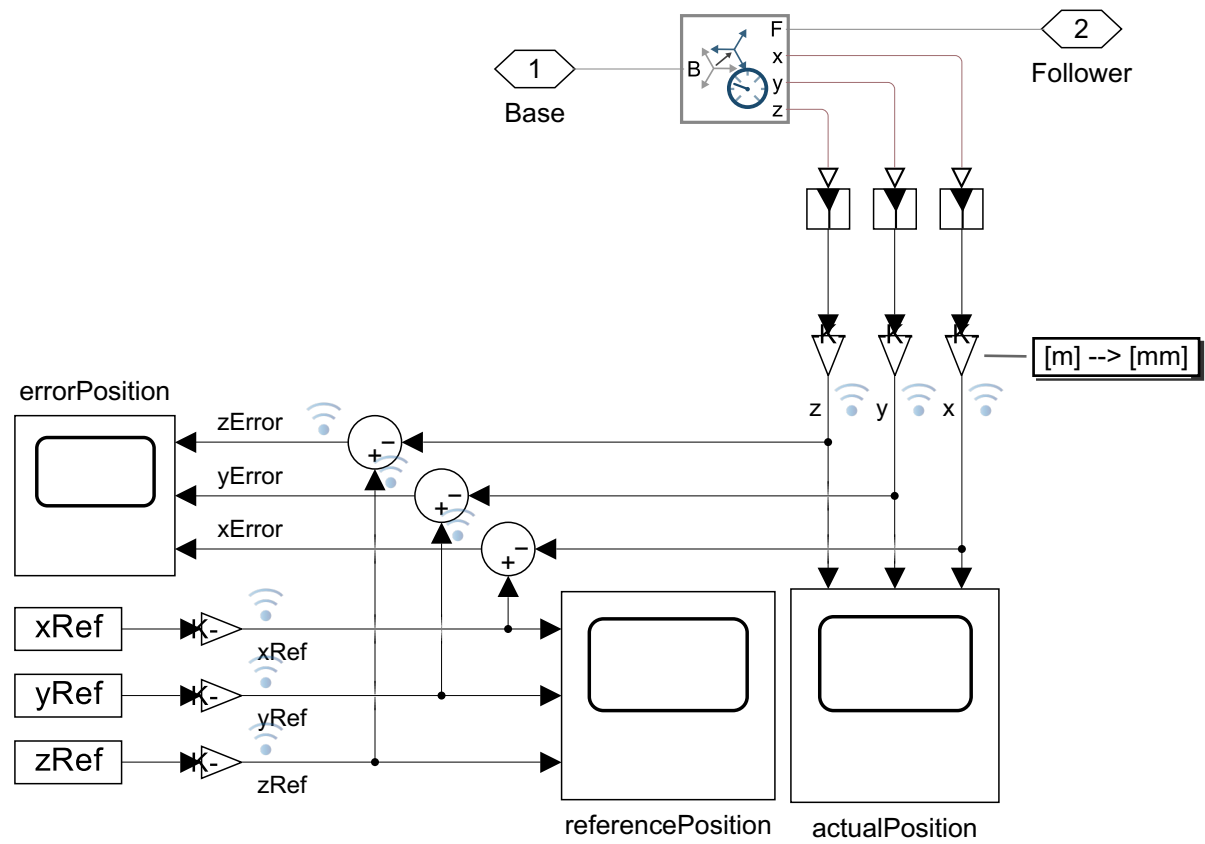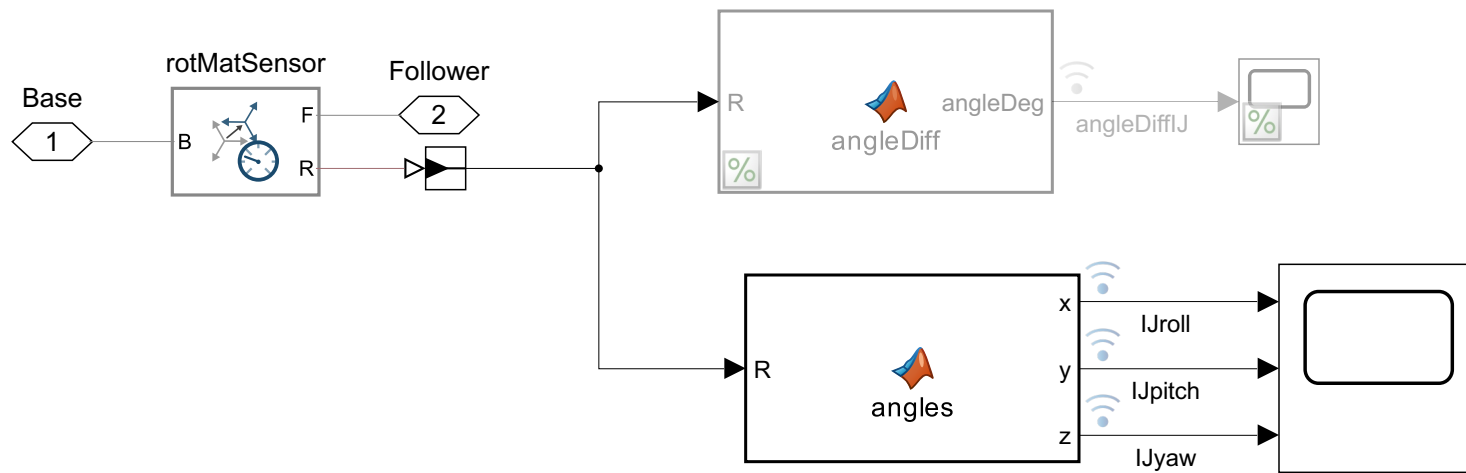**Robot Arm Model:** Forward Dynamics

Joint inertias are attached to follower bodies axes:
- Joint A: body AB, z-axis
- Joint BE: body BE, x-axis
- Joint BD: body BDstick, y-axis
- Joint G: body GH, z-axis
- Joint H: body HI, y-axis
- Joint I: body IJblock, z-axis

Joint A - Actuated
RJA
[thetaA]
[P_A]
P_A
refA
refA(1,2)
control_A

ABC
T_AB-CoG
AB
T_BC-CoG
BC

T_BC

Joint E
RJE
[thetaE]
T_BE

BE
R_BE-CoG
T_BE-CoG
BE
T_BEvisualN
T_BEvisualP

Joint G - Actuated
RJG
[thetaG]
TR_EG
refG
refG(1,2)
control_G

GH
T_GH-CoG
GH

Joint H - Actuated
RJH
[thetaH]
TR_GH
refH
refH(1,2)
control_H
P_H
[P_H]

Joint B - Actuated
TR_AtoB
RJB-BE
[thetaBE]
refBE(1,2)
refBE
P_BE
[P_BE]
control_BE
RJB-BD
[thetaBD]
P_BD
[P_BD]
refBD
refBD(1,2)
control_BD

BD Block
BDblock
T_BDb-CoG
R_BDb-CoG

BD Stick
R_BDs-CoG
T_BDs-CoG
BDstick
T_BDsVisualN
BDstickVisualN
T_BDsVisualP
BDstickVisualP

EFG
T_EFG-CoG
EFG

Total Power
[P_A]
[P_BE]
[P_BD]
[P_G]
[P_H]
[P_I]
P_tot

DF
T_DFvisualP
DF
T_DF-CoG
R_DF-CoG1
T_DFvisualN

Joint D
T_BD
RJD
[thetaD]
T_DvisB-N
T_DvisB-P

Joint F
T_BF
RJF
[thetaF]

T_EF

HI
HI
T_HI-CoG
R_HI-CoG

R_HI

Joint I - Actuated
RJI
[thetaI]
P_I
[P_I]
control_I
refI
refI(1,2)

IJ
IJblock
T_IJ-CoG
IJcone
TR_IJ

Angle Position to Workspace File
thetaA_tag   [thetaA]
thetaBD_tag   [thetaBD]
thetaBE_tag   [thetaBE]
thetaD_tag   [thetaD]
thetaE_tag   [thetaE]
thetaF_tag   [thetaF]
thetaG_tag   [thetaG]
thetaH_tag   [thetaH]
thetaI_tag   [thetaI]

End Effector Sensors
PositionSensor
Base   Follower
Base   Follower
RotationSensor

Point J
J

Base

1

rotMatSensor

B   F   Follower

2

R

angleDiff

R   angleDeg   angleDiffIJ

%

angles

R   x   IJroll

y   IJpitch

z   IJyaw

```matlab
function angleDeg = angleDiff(R)

axang = rotm2axang(R);

angleDeg = rad2deg(axang(4));
```

```
function [x,y,z] = angles(R)

xEul = rotm2eul(R, 'XYZ');
x = rad2deg(xEul(1));
yEul = rotm2eul(R, 'YXZ');
y = rad2deg(yEul(1));
zEul = rotm2eul(R, 'ZYX');
z = rad2deg(zEul(1)) + 90; % Since it is rotated about world z-frame :)
```