ISTITUTO ITALIANO DI TECNOLOGIA
ADVANCED ROBOTICS

Walk-man
Dims and Inertia

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ADVR Dept.28/11/2014

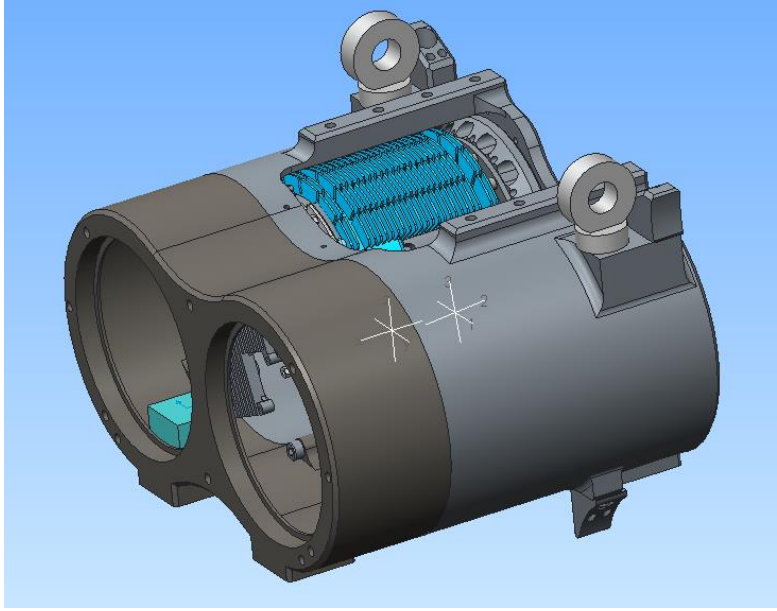
Legs Link section

JOINT RANGES

LINK	DEG	RAD
hip roll		
ab	-50	-0.87222
ad	40	0.697778
hip yaw		
Sup.	-90	-1.57
Pron.	50	0.872222
hip pitch		
Ext.	-120	-2.09333
Flex.	60	1.046667
knee pitch		
Ext.	0	0
Flex.	140	2.442222
ankle pitch		
Ext.	-80	-1.39556
Flex.	40	0.697778
ankle roll		
ab	-45	-0.785
ad	45	0.785

Pelvis

Note: the origin is in the middle of the pelvis



VOLUME = 1.6985800e+06 MM^3
SURFACE AREA = 1.0613625e+06 MM^2
AVERAGE DENSITY = 3.7726163e-06 KILOGRAM / MM^3
MASS = 6.4080904e+00 KILOGRAM

CENTER OF GRAVITY with respect to URDF_ORIGIN_FRAME coordinate frame:
X Y Z -3.2862932e+01 -5.0930727e-01 -1.2899617e+00 MM

INERTIA with respect to URDF_ORIGIN_FRAME coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 3.8838403e+04 1.8322173e+02 4.1810469e+02
Iyx Iyy Iyz 1.8322173e+02 3.1981597e+04 -1.7580654e+01
Izx Izy Izz 4.1810469e+02 -1.7580654e+01 5.4977508e+04

INERTIA at CENTER OF GRAVITY with respect to URDF_ORIGIN_FRAME coordinate frame:
(KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 3.8826078e+04 2.9047605e+02 6.8975598e+02
Iyx Iyy Iyz 2.9047605e+02 2.5050374e+04 -1.3370623e+01
Izx Izy Izz 6.8975598e+02 -1.3370623e+01 4.8055286e+04

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.5044218e+04 3.8780966e+04 4.8106554e+04

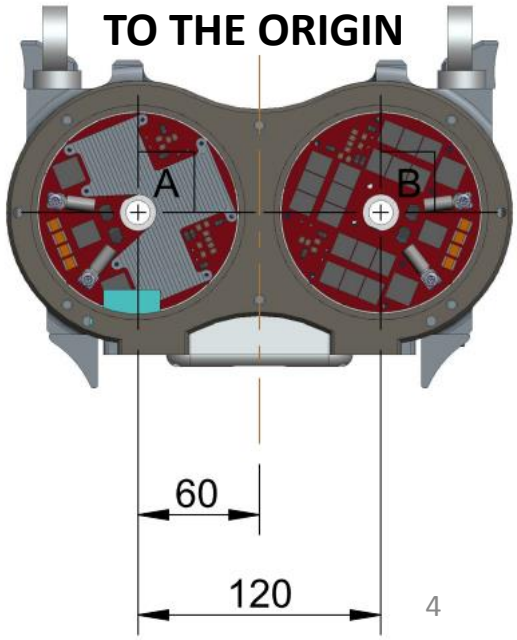
ROTATION MATRIX from URDF_ORIGIN_FRAME orientation to PRINCIPAL AXES:
-0.02113 -0.99702 0.07413
0.99978 -0.02116 0.00036
0.00121 0.07412 0.99725

ROTATION ANGLES from URDF_ORIGIN_FRAME orientation to PRINCIPAL AXES (degrees):
angles about x y z 0.000 4.251 91.214

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 6.2515746e+01 7.7793803e+01 8.6643863e+01 MM

JOINT FRAME LOCATION RESPECT TO THE ORIGIN

X:105.9 mm
Y:-60/+60 mm
Z: 0 mm



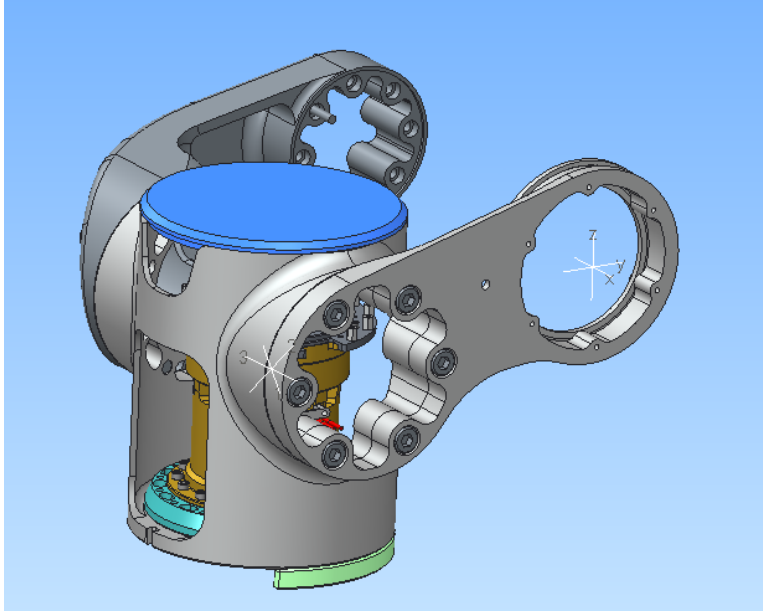
HIP ROLL LINK (RX)

VOLUME = 1.0946176e+06 MM^3
SURFACE AREA = 6.2449456e+05 MM^2
AVERAGE DENSITY = 3.4677130e-09 TONNE / MM^3
MASS = 3.7958197e-03 TONNE

CENTER OF GRAVITY with respect to JOINT_URDF_AXIS coordinate frame:
X Y Z -1.0348188e+02 -1.0919813e+02 -6.4924056e+01 MM

INERTIA with respect to JOINT_URDF_AXIS coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 7.6901138e+01 -4.1042402e+01 -2.3111296e+01
Iyx Iyy Iyz -4.1042402e+01 8.0167166e+01 -2.9241106e+01
Izx Izy Izz -2.3111296e+01 -2.9241106e+01 1.0686341e+02



INERTIA at CENTER OF GRAVITY with respect to JOINT_URDF_AXIS coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.5639017e+01 1.8504661e+00 2.3907793e+00
Iyx Iyy Iyz 1.8504661e+00 2.3519749e+01 -2.3303162e+00
Izx Izy Izz 2.3907793e+00 -2.3303162e+00 2.0953643e+01

PRINCIPAL MOMENTS OF INERTIA: (TONNE * MM^2)
I1 I2 I3 1.4009617e+01 2.1187212e+01 2.4915580e+01

ROTATION MATRIX from JOINT_URDF_AXIS orientation to PRINCIPAL AXES:
0.87992 0.47253 -0.04955
-0.26744 0.40641 -0.87368
-0.39270 0.78202 0.48398

ROTATION ANGLES from JOINT_URDF_AXIS orientation to PRINCIPAL AXES (degrees):
angles about x y z 61.016 -2.840 -28.236

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 6.0751966e+01 7.4710926e+01 8.1018223e+01 MM

HIP YAW JOINT FRAME LOCATION RESPECT TO THE ROLL JOINT AXIS

X:-88.9 mm
Y:-121.032mm
Z: -217.872 mm

JOINT RANGE:

-50deg abduction/ -0.872 rad
+40deg adduction/ 0.698 rad

PEAK TORQUE: 220Nm

HIP YAW LINK (RX)

VOLUME = 8.2179047e+05 MM^3
SURFACE AREA = 5.4269426e+05 MM^2
AVERAGE DENSITY = 3.9428625e-06 KILOGRAM / MM^3
MASS = 3.2402068e+00 KILOGRAM

CENTER OF GRAVITY with respect to URDF_JOINT_AXIS coordinate frame:
X Y Z -5.2929709e+00 -2.2561833e+01 5.6701669e+00 MM

INERTIA with respect to URDF_JOINT_AXIS coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.1855656e+04 -2.7835780e+02 3.5015913e+02
Iyx Iyy Iyz -2.7835780e+02 6.9096514e+03 4.9796466e+02
Izx Izy Izz 3.5015913e+02 4.9796466e+02 1.2225289e+04

INERTIA at CENTER OF GRAVITY with respect to URDF_JOINT_AXIS coordinate frame: (KILOGRAM * MM^2)

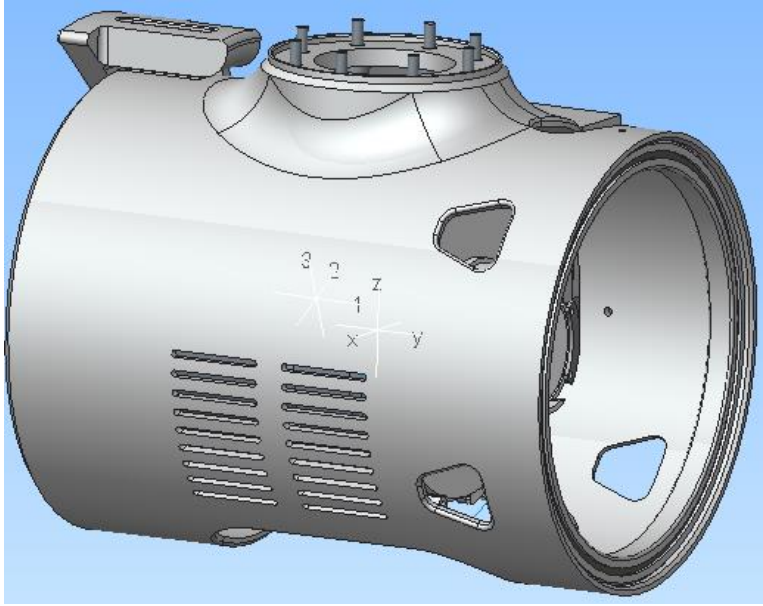
INERTIA TENSOR:
Ixx Ixy Ixz 1.0102097e+04 1.0858487e+02 2.5291395e+02
Iyx Iyy Iyz 1.0858487e+02 6.7147000e+03 8.3447072e+01
Izx Izy Izz 2.5291395e+02 8.3447072e+01 1.0485130e+04

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 6.7097129e+03 9.9774679e+03 1.0614747e+04

ROTATION MATRIX from URDF_JOINT_AXIS orientation to PRINCIPAL AXES:
-0.03049 -0.89372 0.44759
0.99933 -0.01828 0.03158
-0.02005 0.44825 0.89368

ROTATION ANGLES from URDF_JOINT_AXIS orientation to PRINCIPAL AXES (degrees):
angles about x y z -2.024 26.589 91.954

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.5505679e+01 5.5491160e+01 5.7235892e+01 MM



HIP PITCH JOINT FRAME LOCATION RESPECT TO THE YAW JOINT AXIS

X:0 mm
Y:0mm
Z: 0mm

JOINT RANGE:
-90deg / -1.57rad
+50deg / 0.872rad

PEAK TORQUE: 120Nm

HIP PITCH LINK (RX)

VOLUME = 1.5735748e+06 MM^3
SURFACE AREA = 1.0039812e+06 MM^2
AVERAGE DENSITY = 3.2378974e-06 KILOGRAM / MM^3
MASS = 5.0950736e+00 KILOGRAM

CENTER OF GRAVITY with respect to URDF_PITCH_JOINT coordinate frame:
X Y Z 3.7746286e+01 -2.8539939e+01 -1.9310133e+02 MM

INERTIA with respect to URDF_PITCH_JOINT coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.4574367e+05 7.7141514e+03 3.9590247e+04
Iyx Iyy Iyz 7.7141514e+03 2.4159425e+05 -3.2180155e+04
Izx Izy Izz 3.9590247e+04 -3.2180155e+04 3.4783904e+04

INERTIA at CENTER OF GRAVITY with respect to URDF_PITCH_JOINT coordinate frame: (KILOGRAM * MM^2)

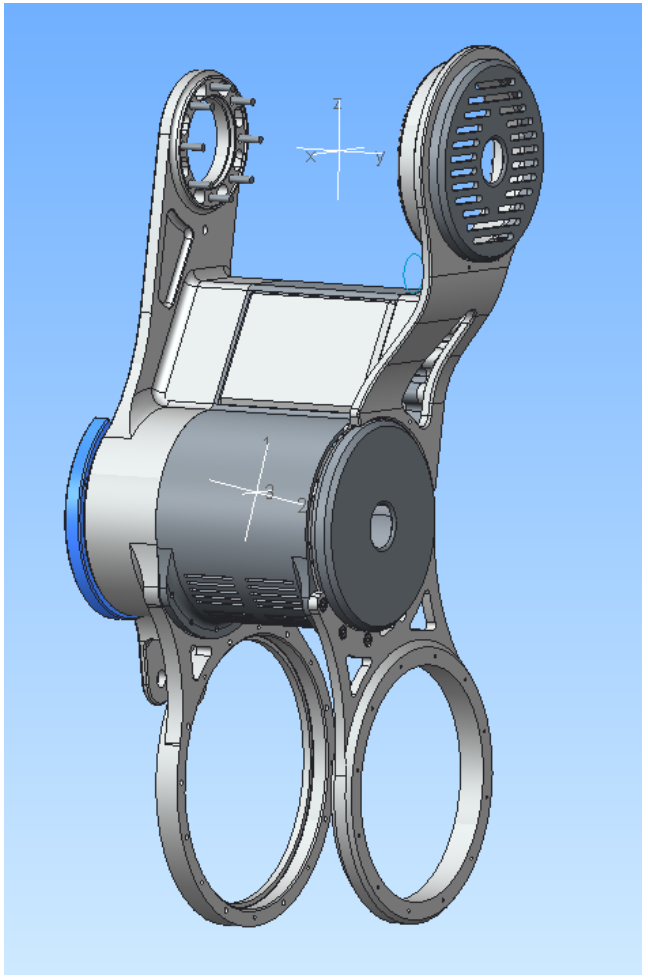
INERTIA TENSOR:
Ixx Ixy Ixz 5.1607858e+04 2.2253472e+03 2.4529790e+03
Iyx Iyy Iyz 2.2253472e+03 4.4349153e+04 -4.1006942e+03
Izx Izy Izz 2.4529790e+03 -4.1006942e+03 2.3374453e+04

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.2327869e+04 4.4708982e+04 5.2294613e+04

ROTATION MATRIX from URDF_PITCH_JOINT orientation to PRINCIPAL AXES:
-0.09639 -0.23201 -0.96793
0.19162 0.94994 -0.24678
0.97672 -0.20926 -0.04711

ROTATION ANGLES from URDF_PITCH_JOINT orientation to PRINCIPAL AXES (degrees):
angles about x y z 100.807 -75.449 112.561

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 6.6198539e+01 9.3674668e+01 1.0131022e+02 MM



KNEE PITCH JOINT FRAME LOCATION RESPECT TO THE HIP PITCH JOINT AXIS

X:0 mm
Y:0mm
Z: -356mm

JOINT RANGE:

-120deg / -2.093rad
+60deg / 1.046rad

PEAK TORQUE: 220Nm

KNEE PITCH LINK (RX)

VOLUME = 1.6750798e+06 MM^3
SURFACE AREA = 8.4278252e+05 MM^2
AVERAGE DENSITY = 3.4552450e-06 KILOGRAM / MM^3
MASS = 5.6495309e+00 KILOGRAM

CENTER OF GRAVITY with respect to CALF_URDF coordinate frame:
X Y Z -5.0828668e+00 3.7732093e+00 -7.2605017e+01 MM

INERTIA with respect to CALF_URDF coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.3521729e+05 -4.7364144e+02 -4.1055231e+02 Iyx Iyy Iyz -4.7364144e+02 1.2778519e+05 -1.8293069e+03 Izx Izy Izz -4.1055231e+02 -1.8293069e+03 2.1080478e+04

INERTIA at CENTER OF GRAVITY with respect to CALF_URDF coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.0535542e+05 -5.8199221e+02 1.6743598e+03 Iyx Iyy Iyz -5.8199221e+02 9.7857796e+04 -3.3770181e+03 Izx Izy Izz 1.6743598e+03 -3.3770181e+03 2.0854086e+04

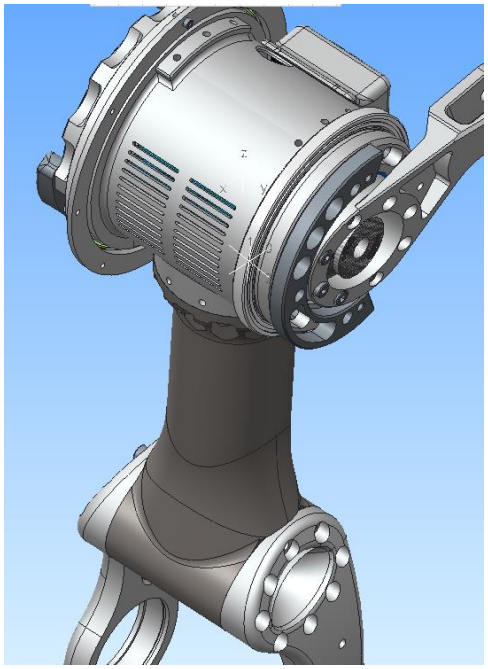
PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.0674223e+04 9.7948028e+04 1.0544505e+05

ROTATION MATRIX from CALF_URDF orientation to PRINCIPAL AXES:

-0.01945	0.08762	-0.99596
0.04356	0.99528	0.08671
0.99886	-0.04169	-0.02318

ROTATION ANGLES from CALF_URDF orientation to PRINCIPAL AXES (degrees):
angles about x y z-104.964 -84.850 -102.516

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 6.0493457e+01 1.3167146e+02 1.3661768e+02 MM



ANKLE PITCH JOINT FRAME LOCATION RESPECT TO THE KNEE PITCH JOINT AXIS

X:0mm
Y:0mm
Z: 400mm

JOINT RANGE:
0deg / 0 rad
+140deg / 2.442rad

PEAK TORQUE: 220Nm

ANKLE PITCH LINK (RX)

VOLUME = 7.9991704e+05 MM^3
SURFACE AREA = 5.1081364e+05 MM^2
AVERAGE DENSITY = 4.1059456e-06 KILOGRAM / MM^3
MASS = 3.2844159e+00 KILOGRAM

CENTER OF GRAVITY with respect to ANKLE_PITCH_URDF coordinate frame:
X Y Z -2.2024173e+01 2.5677238e+00 9.4588455e-01 MM

INERTIA with respect to ANKLE_PITCH_URDF coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 7.5796613e+03 8.6062318e+02 1.2675491e+02 Iyx Iyy Iyz 8.6062318e+02 1.2837254e+04 -1.5349790e+02 Izx Izy Izz
1.2675491e+02 -1.5349790e+02 1.5006672e+04

INERTIA at CENTER OF GRAVITY with respect to ANKLE_PITCH_URDF coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 7.5550679e+03 6.7488292e+02 5.8332889e+01 Iyx Iyy Iyz 6.7488292e+02 1.1241163e+04 -1.4552081e+02 Izx Izy Izz 5.8332889e+01 -1.4552081e+02 1.3391865e+04

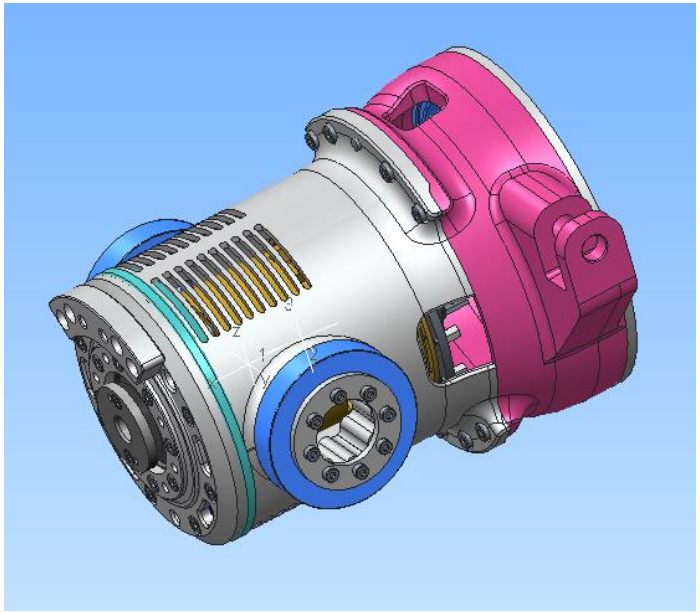
PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 7.4342371e+03 1.1352163e+04 1.3401695e+04

ROTATION MATRIX from ANKLE_PITCH_URDF orientation to PRINCIPAL AXES:

0.98446	0.17559	0.00228
-0.17505	0.98231	-0.06649
-0.01392	0.06506	0.99778

ROTATION ANGLES from ANKLE_PITCH_URDF orientation to PRINCIPAL AXES (degrees):
angles about x y z 3.813 0.131 -10.113

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.7576132e+01 5.8790918e+01 6.3877925e+01 MM



ANKLE ROLL JOINT FRAME LOCATION RESPECT TO THE YAW JOINT AXIS

To check with lewis,
Below there is the placement
I suggest

X:0mm
Y:0mm
Z: 0mm

JOINT RANGE:

-80deg / -1.395 rad
+40deg / 0.697rad

PEAK TORQUE: 220Nm

ANKLE ROLL LINK (RX)

OTHER DATA
FROM Lewis

JOINT RANGE:

-45deg / -0.785 rad
+45deg / 0.785rad

PEAK TORQUE: 120Nm

Forearm Link section

ELBOW PITCH LINK (RX)

VOLUME = 2.5885496e+05 MM^3
SURFACE AREA = 1.6712451e+05 MM^2
AVERAGE DENSITY = 3.3518919e-06 KILOGRAM / MM^3
MASS = 8.6765385e-01 KILOGRAM

CENTER OF GRAVITY with respect to URDF_FRAME_FA_RX_JOINT1 coordinate frame:
X Y Z -5.5754915e+01 -7.5826040e+00 -4.3820396e+01 MM

INERTIA with respect to URDF_FRAME_FA_RX_JOINT1 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 5.7555028e+03 -1.7084442e+01 -2.8038587e+03
Iyx Iyy Iyz -1.7084442e+01 6.6093465e+03 1.4674364e-01
Izx Izy Izz -2.8038587e+03 1.4674364e-01 7.2365871e+03

INERTIA at CENTER OF GRAVITY with respect to URDF_FRAME_FA_RX_JOINT1 coordinate frame: (KILOGRAM * MM^2)

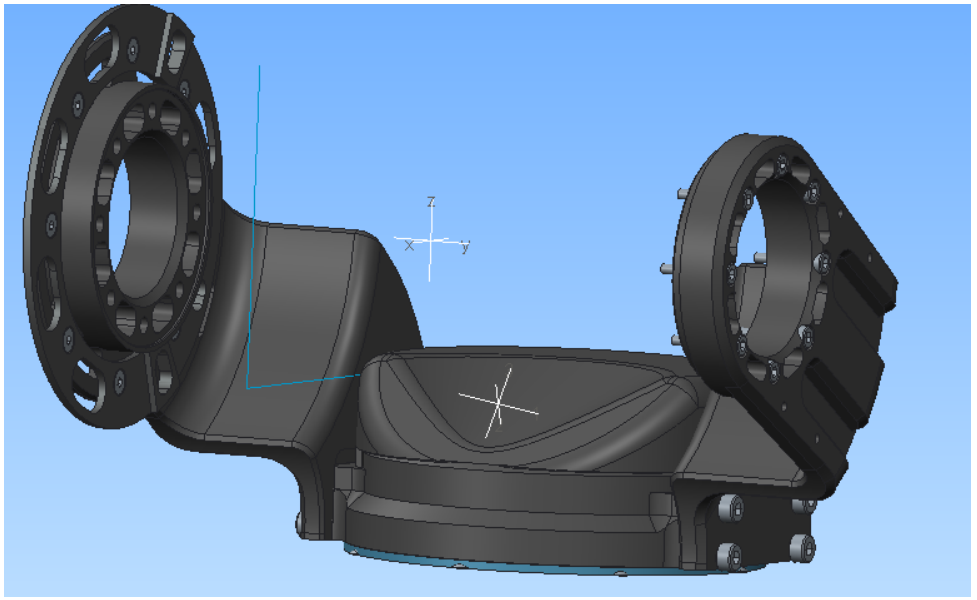
INERTIA TENSOR:
Ixx Ixy Ixz 4.0395238e+03 3.4973136e+02 -6.8400465e+02
Iyx Iyy Iyz 3.4973136e+02 2.2460561e+03 2.8844444e+02
Izx Izy Izz -6.8400465e+02 2.8844444e+02 4.4895027e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.1036983e+03 3.6864985e+03 4.9848858e+03

ROTATION MATRIX from URDF_FRAME_FA_RX_JOINT1 orientation to PRINCIPAL AXES:
-0.23713 -0.77674 -0.58348
0.95402 -0.29953 0.01102
-0.18333 -0.55404 0.81206

ROTATION ANGLES from URDF_FRAME_FA_RX_JOINT1 orientation to PRINCIPAL AXES (degrees):
angles about x y z -0.777 -35.695 106.977

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.9240049e+01 6.5182915e+01 7.5797408e+01 MM



ELBOW PITCH JOINT FRAME LOCATION RESPECT TO THE PREVIOUS JOINT AXIS:

X:0mm
Y:0mm
Z: 0mm

FOREARM YAW JOINT FRAME LOCATION RESPECT TO THE ELBOW PITCH JOINT AXIS:

X:-75mm
Y:0mm
Z: -195.5mm

JOINT RANGE:

- deg / rad
+ deg / rad

PEAK TORQUE: 60Nm

FOREARM YAW LINK (RX)

VOLUME = 5.0098507e+05 MM^3
SURFACE AREA = 4.5291385e+05 MM^2
AVERAGE DENSITY = 4.4168355e-06 KILOGRAM / MM^3
MASS = 2.2127686e+00 KILOGRAM

CENTER OF GRAVITY with respect to URDF_FRAME_FA_JOINT2 coordinate frame:
X Y Z 1.2625599e-02 -4.2975381e+00 4.4717986e+01 MM

INERTIA with respect to URDF_FRAME_FA_JOINT2 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.1008574e+04 4.1317030e+01 2.0234169e+00
Iyx Iyy Iyz 4.1317030e+01 1.0012699e+04 4.3571063e+00
Izx Izy Izz 2.0234169e+00 4.3571063e+00 2.5191699e+03

INERTIA at CENTER OF GRAVITY with respect to URDF_FRAME_FA_JOINT2 coordinate frame: (KILOGRAM * MM^2)

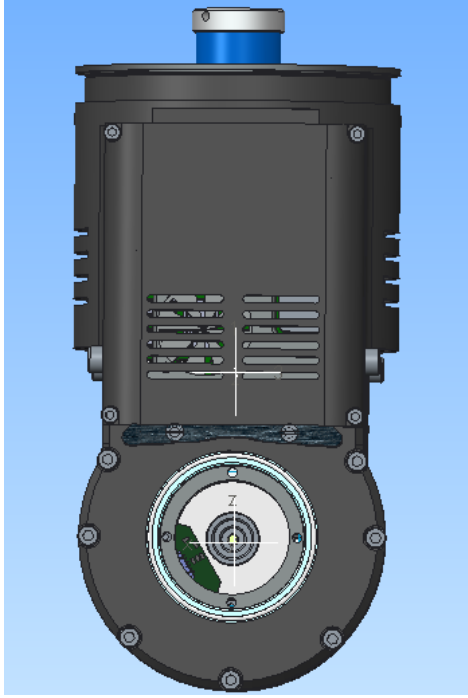
INERTIA TENSOR:
Ixx Ixy Ixz 6.5428368e+03 4.1196967e+01 3.2727270e+00
Iyx Iyy Iyz 4.1196967e+01 5.5878290e+03 -4.2088668e+02
Izx Izy Izz 3.2727270e+00 -4.2088668e+02 2.4783023e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.4223225e+03 5.6419782e+03 6.5446673e+03

ROTATION MATRIX from URDF_FRAME_FA_JOINT2 orientation to PRINCIPAL AXES:

-0.00211	-0.04481	-0.99899
0.13183	0.99026	-0.04469
0.99127	-0.13179	0.00382

ROTATION ANGLES from URDF_FRAME_FA_JOINT2 orientation to PRINCIPAL AXES (degrees):
angles about x y z 85.112 -87.429 92.690



FOREARM PITCH JOINT FRAME LOCATION RESPECT TO THE FOREARM YAW JOINT FRAME

X:0mm
Y:0mm
Z: 0mm

JOINT RANGE:
- 145 deg / -2.529 rad
+ 145 deg / 2.529 rad

PEAK TORQUE: 60Nm

FOREARM PITCH LINK (RX)

VOLUME = 3.2699490e+05 MM^3
SURFACE AREA = 2.9031925e+05 MM^2
AVERAGE DENSITY = 3.9260773e-06 KILOGRAM / MM^3
MASS = 1.2838072e+00 KILOGRAM

CENTER OF GRAVITY with respect to URDF_FRAME_FA_JOINT2 coordinate frame:
X Y Z 9.8193770e+00 -1.3797184e+00 -8.0380065e+01 MM

INERTIA with respect to URDF_FRAME_FA_JOINT2 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.0291188e+04 -8.3040721e+00 1.1877215e+03
Iyx Iyy Iyz -8.3040721e+00 1.0593938e+04 -2.1366732e+01
Izx Izy Izz 1.1877215e+03 -2.1366732e+01 1.9566048e+03

INERTIA at CENTER OF GRAVITY with respect to URDF_FRAME_FA_JOINT2 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.9941240e+03 -2.5697060e+01 1.7443538e+02
Iyx Iyy Iyz -2.5697060e+01 2.1755329e+03 1.2100987e+02
Izx Izy Izz 1.7443538e+02 1.2100987e+02 1.8303760e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 1.6915312e+03 2.0896682e+03 2.2188335e+03

ROTATION MATRIX from URDF_FRAME_FA_JOINT2 orientation to PRINCIPAL AXES:
-0.50035 0.84716 0.17878
-0.23492 -0.33158 0.91371
0.83335 0.41517 0.36492

ROTATION ANGLES from URDF_FRAME_FA_JOINT2 orientation to PRINCIPAL AXES (degrees):
angles about x y z -68.229 10.299 -120.567

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 3.6298618e+01 4.0344911e+01 4.1573103e+01 MM

FOREARM ROLL JOINT FRAME LOCATION RESPECT TO THE FOREARM PITCH JOINT AXIS
X:0mm
Y:0mm
Z: -92mm

JOINT RANGE:
- 85deg / -1.48 rad
85deg / 1.48 rad

PEAK TORQUE: 60Nm

FOREARM ROLL LINK (RX)

VOLUME = 1.1050500e+05 MM^3
SURFACE AREA = 8.4192099e+04 MM^2
AVERAGE DENSITY = 3.8732590e-06 KILOGRAM / MM^3
MASS = 4.2801447e-01 KILOGRAM

CENTER OF GRAVITY with respect to URDF_FRAME_FA_JOINT_4 coordinate frame:
X Y Z 7.0380706e+00 1.0811188e-02 -3.9669274e+01 MM

INERTIA with respect to URDF_FRAME_FA_JOINT_4 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 9.5974713e+02 -8.5138036e-02 8.0325351e+01
Iyx Iyy Iyz -8.5138036e-02 1.4073655e+03 2.7858368e-01
Izx Izy Izz 8.0325351e+01 2.7858368e-01 6.3564409e+02

INERTIA at CENTER OF GRAVITY with respect to URDF_FRAME_FA_JOINT_4 coordinate frame: (KILOGRAM * MM^2)

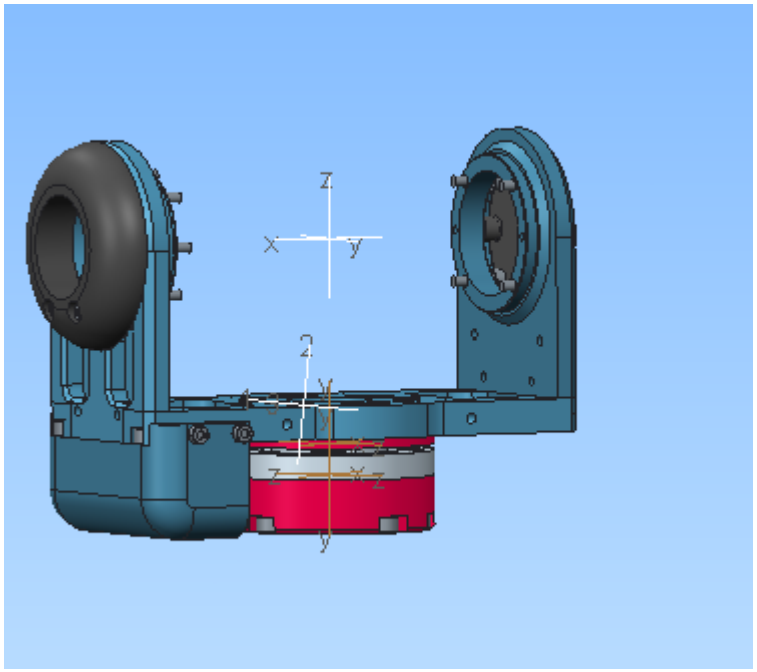
INERTIA TENSOR:
Ixx Ixy Ixz 2.8620156e+02 -5.2570457e-02 -3.9174213e+01
Iyx Iyy Iyz -5.2570457e-02 7.1261855e+02 9.5020266e-02
Izx Izy Izz -3.9174213e+01 9.5020266e-02 6.1444258e+02

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.8159103e+02 6.1905299e+02 7.1261866e+02

ROTATION MATRIX from URDF_FRAME_FA_JOINT_4 orientation to PRINCIPAL AXES:
0.99315 -0.11689 0.00022
0.00010 -0.00107 -1.00000
0.11689 0.99314 -0.00106

ROTATION ANGLES from URDF_FRAME_FA_JOINT_4 orientation to PRINCIPAL AXES (degrees):
angles about x y z 90.060 0.000 6.712

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 2.5649576e+01 3.8030732e+01 4.0803683e+01 MM



Hand JOINT FRAME LOCATION RESPECT TO THE FOREARM roll JOINT frame

X:0mm
Y:0mm
Z: 0mm

JOINT RANGE:

- 85deg / -1.48 rad
85deg / 1.48 rad

PEAK TORQUE: 60Nm

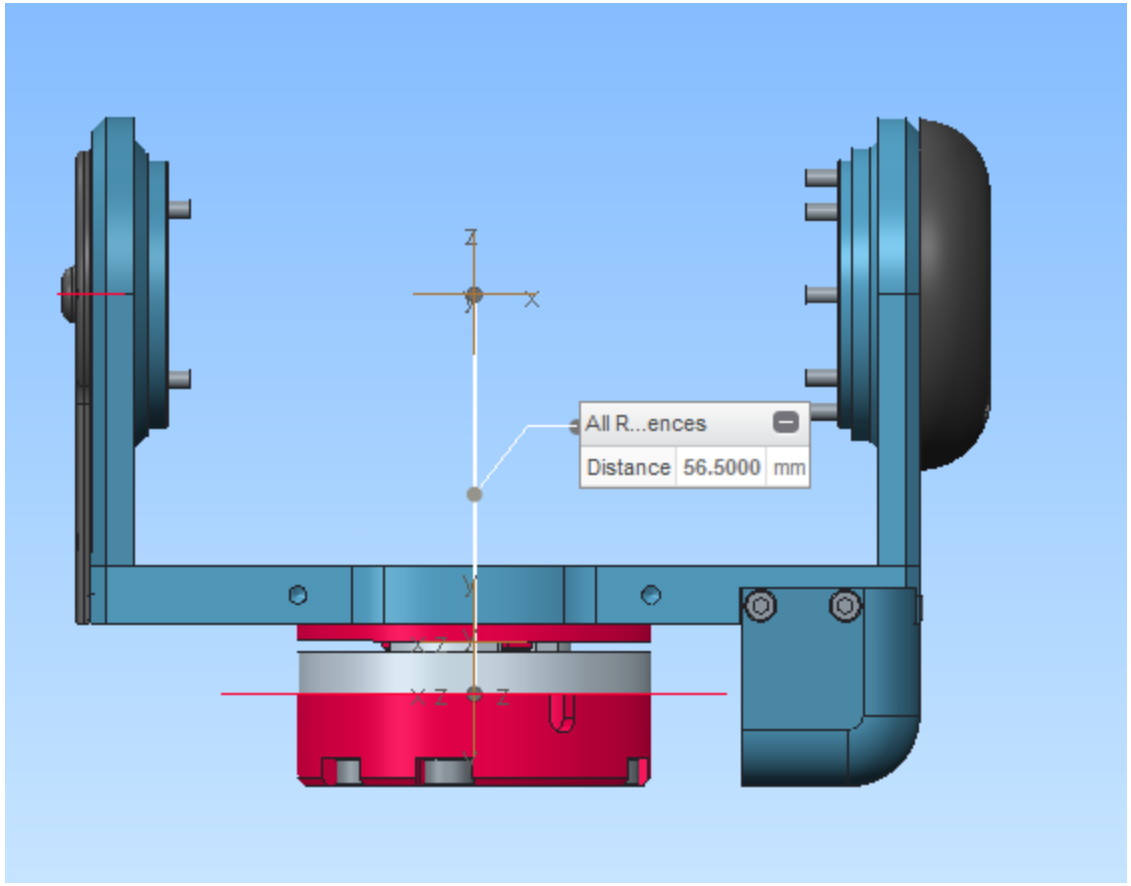
HAND LINK (RX)

To be updated…..

F/T SENSOR PLACEMENT (RX)

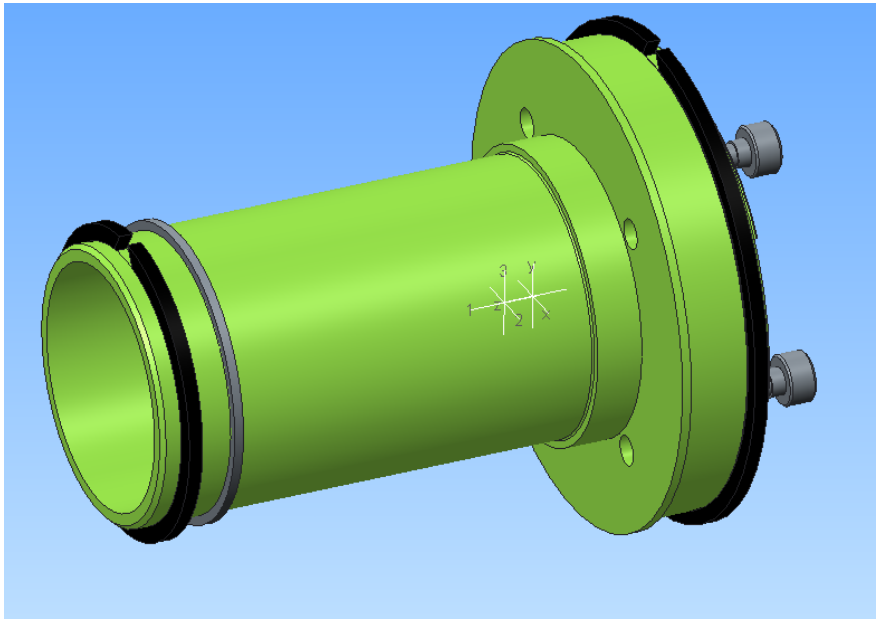
F/T SENSOR FRAME LOCATION RESPECT TO THE FOREARM roll JOINT frame

X:0mm
Y:0mm
Z: 56.5mm



Actuators section

Big actuator: Shaft before gear box



VOLUME = 2.0455367e+04 MM^3
SURFACE AREA = 2.1304325e+04 MM^2
AVERAGE DENSITY = 3.1174016e-09 TONNE / MM^3
MASS = 6.3767593e-05 TONNE

CENTER OF GRAVITY with respect to _ROTOR_ASSEMBLY coordinate frame:
X Y Z 0.0000000e+00 -5.8448818e-02 3.2146704e+00 MM

INERTIA with respect to _ROTOR_ASSEMBLY coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 3.8595581e-02 0.0000000e+00 0.0000000e+00
Iyx Iyy Iyz 0.0000000e+00 3.8675520e-02 3.3875902e-05
Izx Izy Izz 0.0000000e+00 3.3875902e-05 2.1059873e-02

INERTIA at CENTER OF GRAVITY with respect to _ROTOR_ASSEMBLY coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 3.7936382e-02 0.0000000e+00 0.0000000e+00
Iyx Iyy Iyz 0.0000000e+00 3.8016539e-02 2.1894374e-05
Izx Izy Izz 0.0000000e+00 2.1894374e-05 2.1059656e-02

PRINCIPAL MOMENTS OF INERTIA: (TONNE * MM^2)
I1 I2 I3 2.1059627e-02 3.7936382e-02 3.8016567e-02

ROTATION MATRIX from _ROTOR_ASSEMBLY orientation to PRINCIPAL AXES:
0.00000 1.00000 -0.00011
-0.00129 0.00011 1.00000
1.00000 0.00000 0.00129

ROTATION ANGLES from _ROTOR_ASSEMBLY orientation to PRINCIPAL AXES (degrees):
angles about x y z -89.926 0.000 -90.000

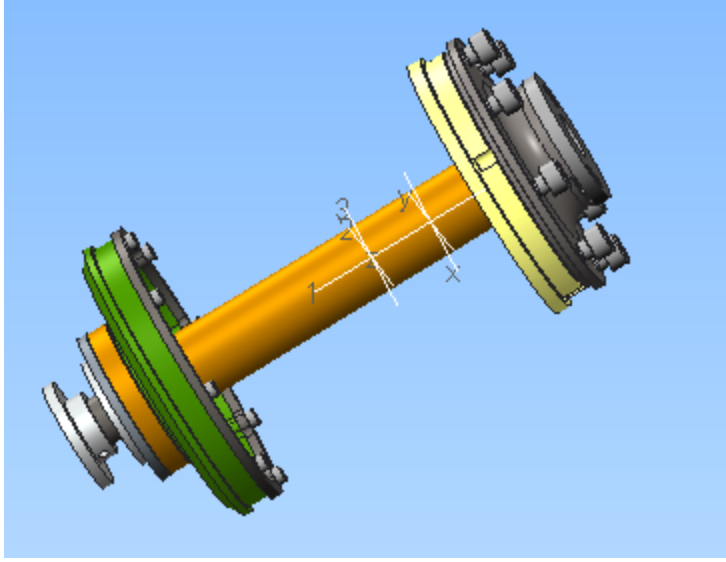
RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 1.8172946e+01 2.4390906e+01 2.4416670e+01 MM

Inertia of the motor rotor:
5.43 x10-5 kg m^2
from the datasheet

Inertia of the harmonic drive:
0,263 x 10 -4 kg m^2 from the datasheet

Reduction ratio: 80.

Big actuator: Shaft after gear box



VOLUME = 8.3525405e+04 MM^3
SURFACE AREA = 9.0330408e+04 MM^2
AVERAGE DENSITY = 4.0560145e-09 TONNE / MM^3
MASS = 3.3878025e-04 TONNE

CENTER OF GRAVITY with respect to _WM0028A0 coordinate frame:
X Y Z 1.8150407e-04 -1.8434214e-04 1.7579705e+01 MM

INERTIA with respect to _WM0028A0 coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.1302565e+00 7.2527702e-06 1.7490136e-06
Iyx Iyy Iyz 7.2527702e-06 1.1299437e+00 -1.7573702e-06
Izx Izy Izz 1.7490136e-06 -1.7573702e-06 1.7595213e-01

INERTIA at CENTER OF GRAVITY with respect to _WM0028A0 coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.0255578e+00 7.2527589e-06 2.8299896e-06
Iyx Iyy Iyz 7.2527589e-06 1.0252450e+00 -2.8552488e-06
Izx Izy Izz 2.8299896e-06 -2.8552488e-06 1.7595213e-01

PRINCIPAL MOMENTS OF INERTIA: (TONNE * MM^2)
I1 I2 I3 1.7595213e-01 1.0252448e+00 1.0255580e+00

ROTATION MATRIX from _WM0028A0 orientation to PRINCIPAL AXES:
0.00000 -0.02317 -0.99973
0.00000 0.99973 -0.02317
1.00000 0.00000 0.00000

ROTATION ANGLES from _WM0028A0 orientation to PRINCIPAL AXES (degrees):
angles about x y z 90.008 -88.673 90.008

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 2.2789679e+01 5.5011660e+01 5.5020061e+01 MM

Big actuator: Shaft after gear box with test rig parts

VOLUME = 4.0397776e+05 MM^3
SURFACE AREA = 1.5604711e+05 MM^2
AVERAGE DENSITY = 5.5858351e-09 TONNE / MM^3
MASS = 2.2565532e-03 TONNE

CENTER OF GRAVITY with respect to _WM0028A0 coordinate frame:
X Y Z 4.8974444e+01 1.1826665e+02 -6.3984696e+01 MM

INERTIA with respect to _WM0028A0 coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 7.2036101e+01 -2.4397073e+01 8.9323242e+00
Iyx Iyy Iyz -2.4397073e+01 2.3241235e+01 2.1568499e+01
Izx Izy Izz 8.9323242e+00 2.1568499e+01 6.9434852e+01

INERTIA at CENTER OF GRAVITY with respect to _WM0028A0 coordinate frame: (TONNE * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 3.1235271e+01 -1.1327020e+01 1.8611555e+00
Iyx Iyy Iyz -1.1327020e+01 8.5904790e+00 4.4925850e+00
Izx Izy Izz 1.8611555e+00 4.4925850e+00 3.2460110e+01

PRINCIPAL MOMENTS OF INERTIA: (TONNE * MM^2)
I1 I2 I3 3.0921155e+00 3.3265314e+01 3.5928431e+01

ROTATION MATRIX from _WM0028A0 orientation to PRINCIPAL AXES:
0.37763 0.06262 0.92384
0.91143 0.15088 -0.38279
-0.16336 0.98657 -0.00009

ROTATION ANGLES from _WM0028A0 orientation to PRINCIPAL AXES (degrees):
angles about x y z 90.014 67.493 -9.415

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 3.7017328e+01 1.2141519e+02 1.2618169e+02 MM