This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at partnersupport@motoman.com for updates or clarification.

Tool Frame Alignment Tips from CAD to Motosim

Introduction

There are many reasons that aligning the origin of a tool to the robot flange is advantageous. With aligning the tool frame in CAD, the user will find that importing a tool to MotoSim and aligning with the robot flange can be time consuming.

Common Mistakes

Most engineers, when designing a tool, do not make use of the assembly file's origin. It might be used to align components to each other, but most of the time it will be found off in a corner somewhere. If they do use the assembly origin to act as the origin of the tool, its location may be correct, but the orientation may not be.

Below is an example of incorrect and correct tool origins.
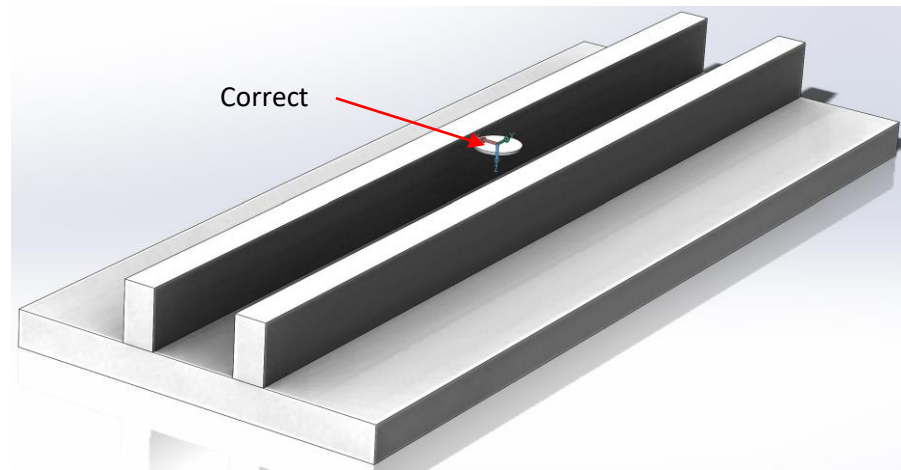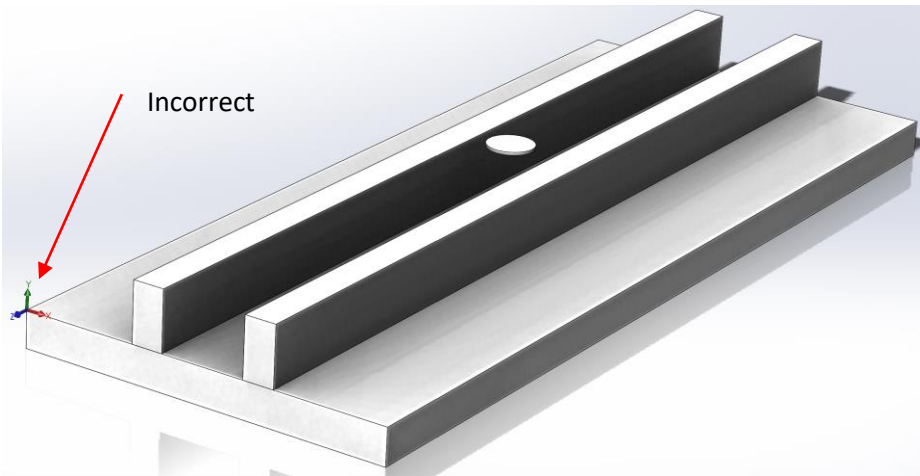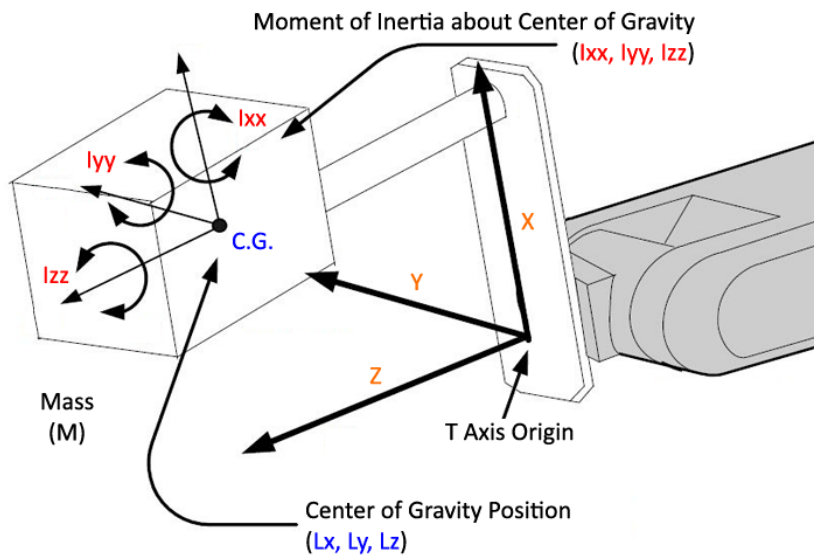
Why is This Important?

There are two reasons why.

1. Aligning the origin correctly with the tool allows for accurate mass data that can be applied to tool calculations, for robot sizing, and used for the controller's tool data, on the manipulator.
2. Having a correctly aligned origin makes very simple to import the CAD model to MotoSim, without having to manually adjust it - saving time and improving accuracy of the simulation.

Reference

Here is a reference image of how a tool should be aligned with the robot flange:

Assume the robot flange is facing out, as in the image to the left.

The X axis is pointing up and the Z axis pointing out…perpendicular to the flange.

X: Direction that is directly above when the T axis is at 0 and the flange surface is turned to the front.
Y: Right-hand rule orthogonal cross product of Z X
Z: Perpendicular normal to the flange surface

Alignment Advantages in CAD

If the model is not already aligned and oriented, use the CAD software to either create a second coordinate system or create a new assembly with the tool as the only component and constrain it to the origin correctly.
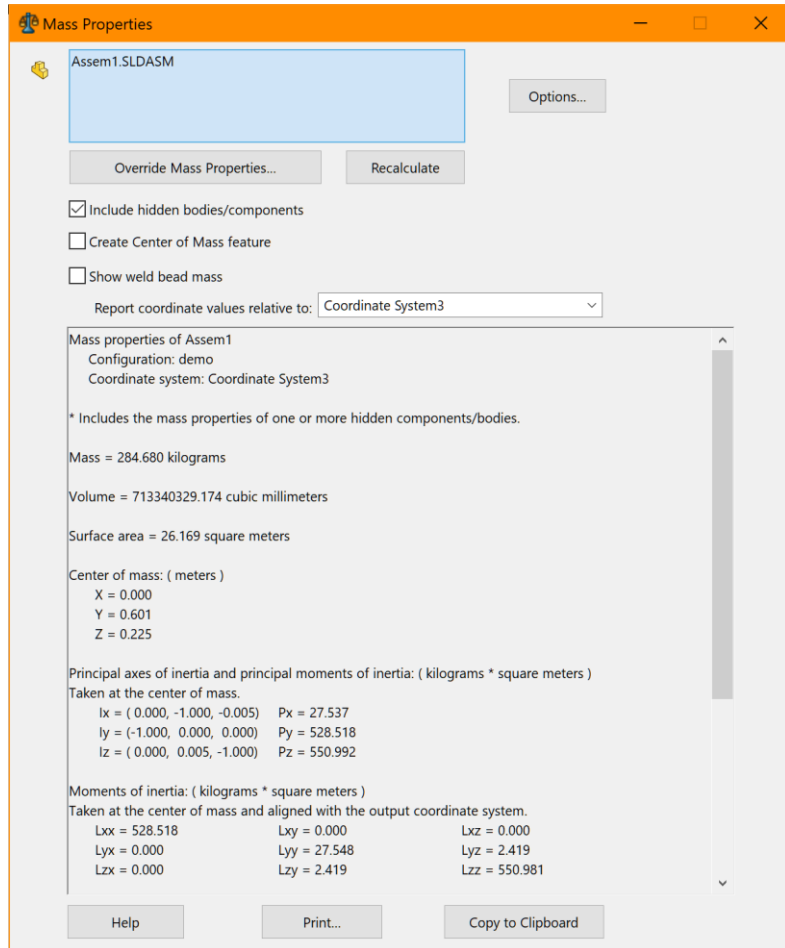
With Solidworks, it is best to select reference geometry under the assembly tab and select coordinate system.

It should look like the image below (the robot model is for reference only):
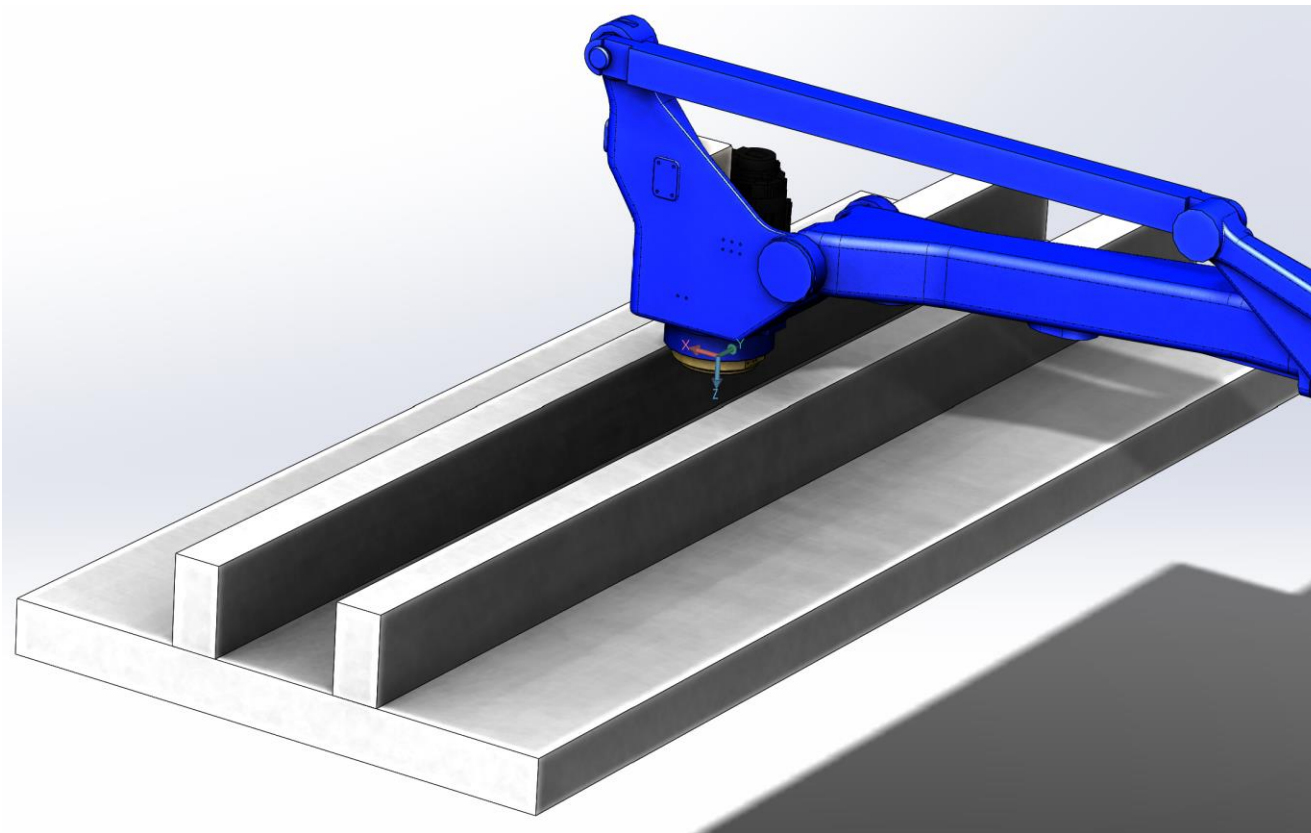
From here the tool can be exported from CAD (make sure the second coordinate system is selected in the export options) without issue or position accurate tool data can be extracted.


The mass will never change, but if the coordinate system was not aligned to the robot flange, then the Center of mass and moments of inertia results would be skewed…causing errors…sometimes large errors for robot sizing calculations.

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Easy Export for Use in Motosim

Having the origin aligned on the tool also allows for easy import into MotoSim - no manual tweaking is required.

When exporting from CAD, make sure to select the second coordinate system during the export process
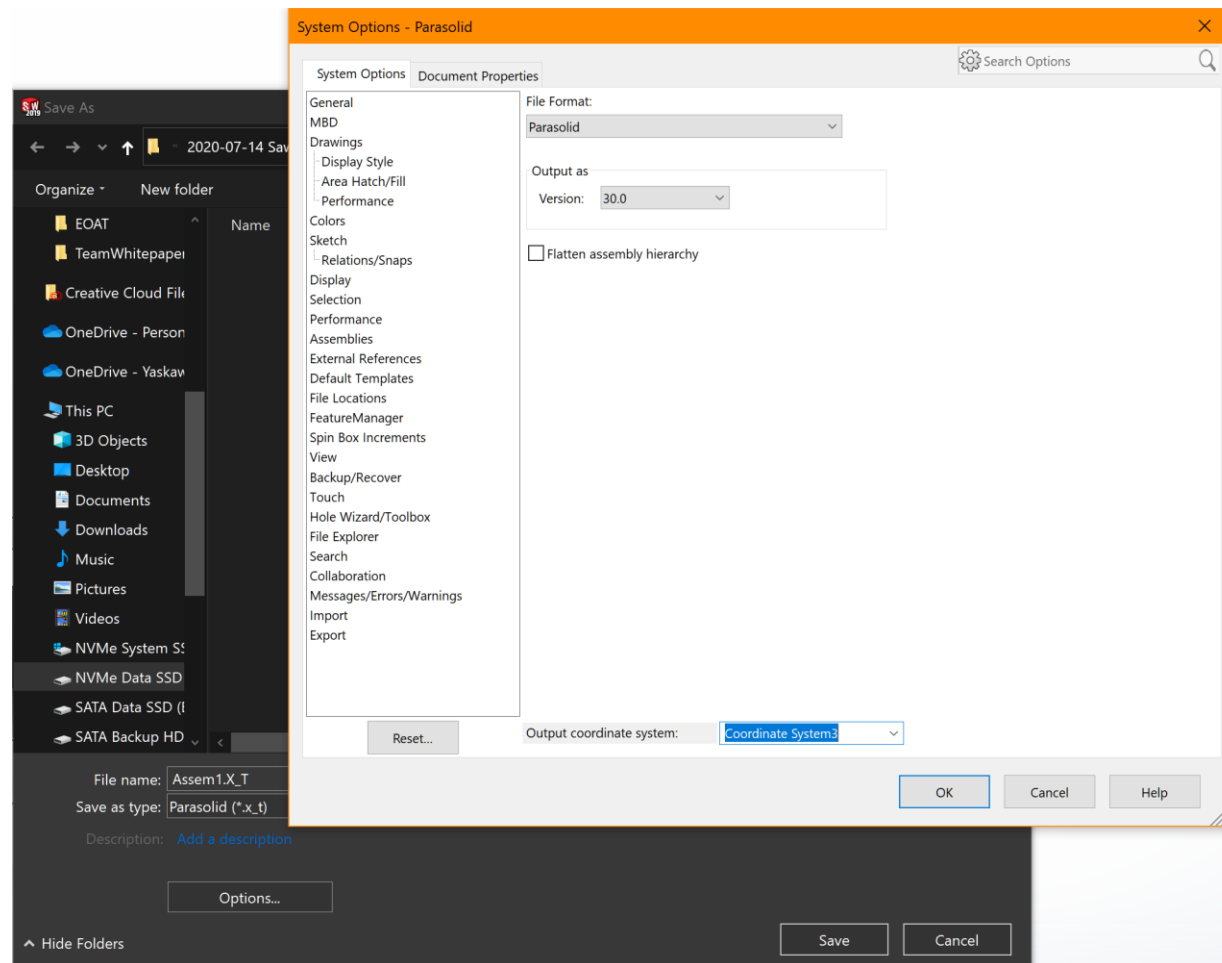
This example was taken from Solidworks.

1. Parasolid v30 format is selected.
2. The Output Coordinate System is changed to the newly created one
3. The new model is saved.

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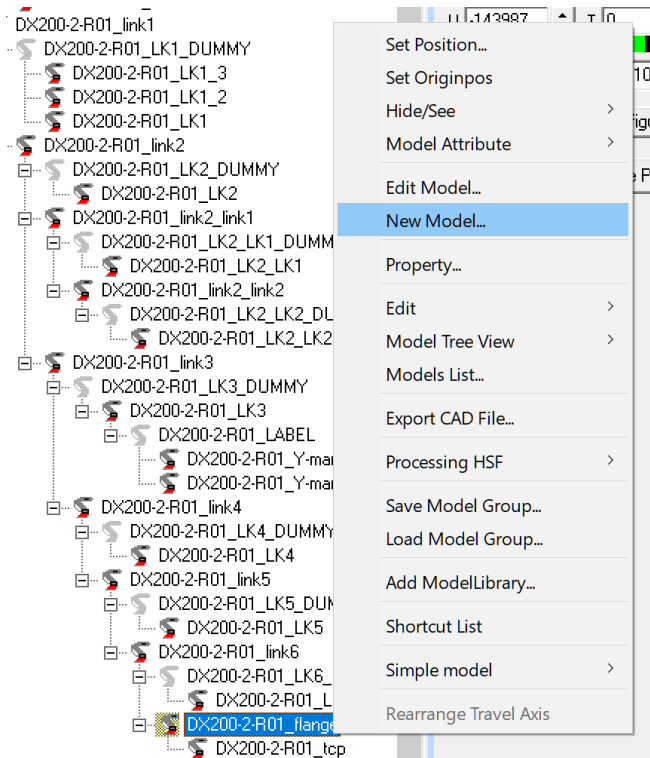
1. In Motosim open the CADtree and fully expand the robot (if there is a number pad, use the * key to quickly expand whatever is hightlighted)
2. Scroll down to the robot flange and highlight it (whatever is hightlighted will be the parent)
3. Right-click on the flange name and select New Model.
4. From here it is the same procedure to import a CAD model…except this will appear attached to the robot flange in the orientation needed.
5. No additional modifications will be necessary.