Solid work & MATLAB

First:

- Install MATLAB R2017a or later versions (I use R2017a)
- Install solid work 2012 or later versions (I use 2014)

Second:

Install sim mechanics link (smlink) add-on that converts cads models to xml file which can be used in MATLAB Simulink

The following link describe the process very good , follow it

https://www.mathworks.com/help/physmod/smlink/ug/installing-and-linking-simmechanics-link-software.html

third:

install multibody contact force library .. there is two methods for that
first method:

Go to the next web page and download the library

https://www.mathworks.com/matlabcentral/fileexchange/47417-simscape-multibody-contact-forces-library#examples_tab

then open the downloaded library- which compatible with matlab version - in matlab path and run the script called *startup_Contact_Forces.m*

second method:
in MATLAB open add-ons and search about contact force library and download it to the path here no need to run a script it will be added automatically to the path

fourth:

in solid work design objects and export them to matlab using smlink add-on then use smimport command to create Simulink model
solid work and matlab.zip file will illustrate that

use contact forces in Simulink model (export from cad model)

another model has been used in the next illustration. An NHTML file will be created as a completion for *solidwork and matlab.zip* ASAP

the dimensions used here has been illustrated figure 1

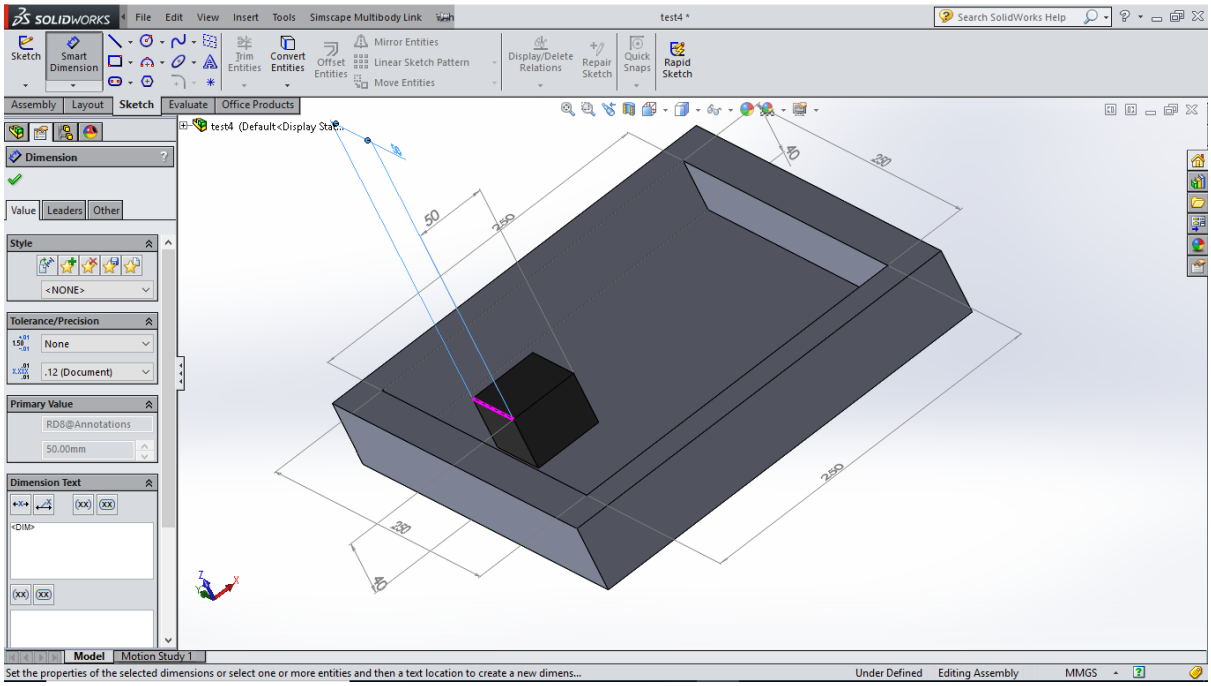
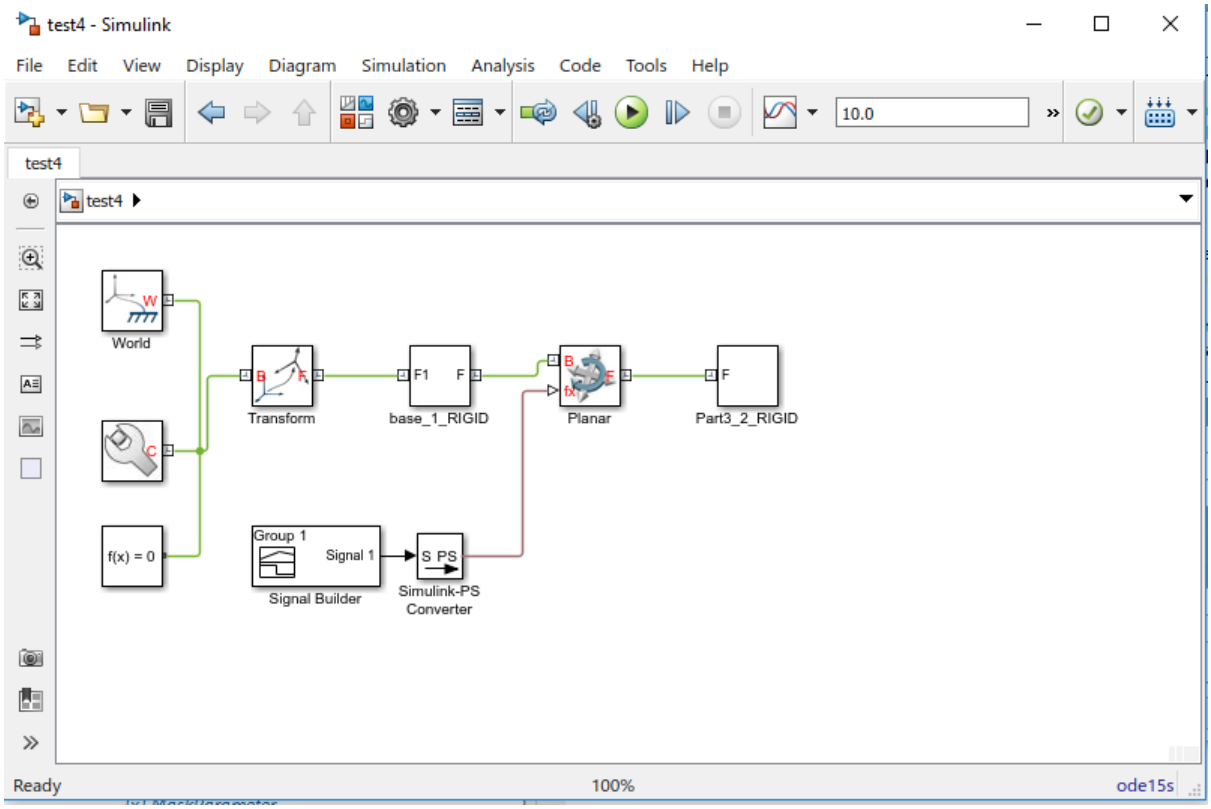


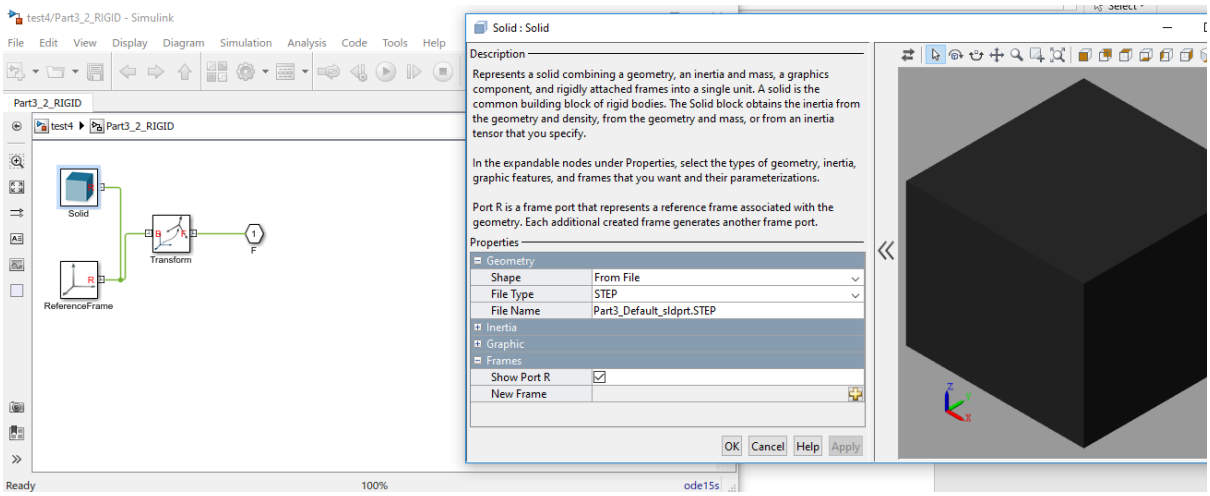
Figure 1: picture illustrate the dimensions that has been used

This model has been exported to matlab and create its assoicated simulink model as shown below



Now i want to add the contact force between the box and fence. contact forces have been added between each face from the fence with all edges of the box

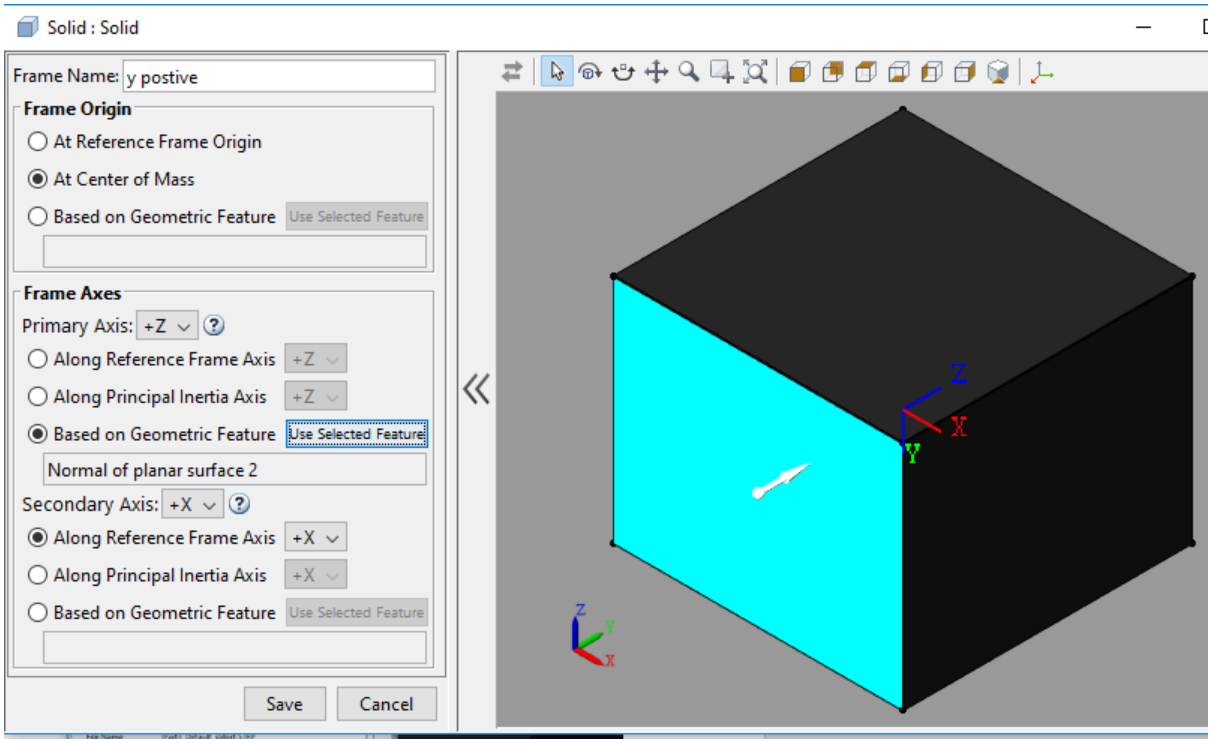
To do that we first double click in part3-2-RIGID then double click in solid. The image below shows what we will get



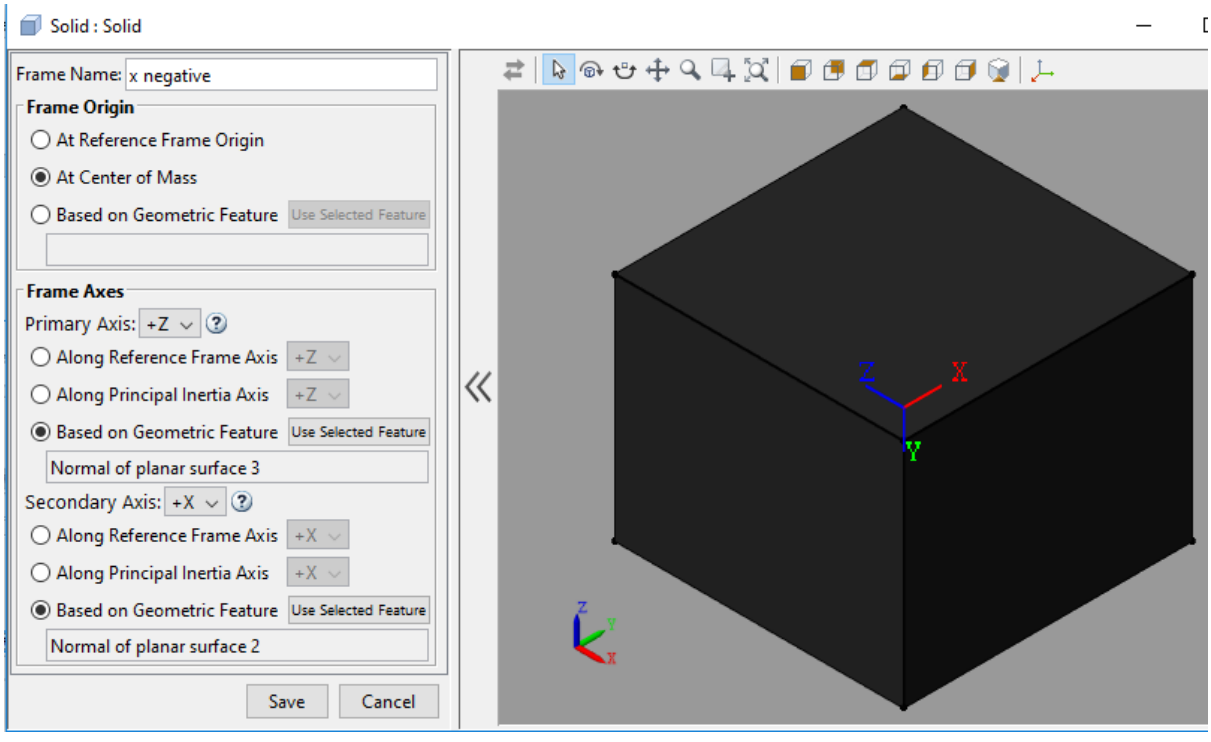
To add contact force, we need to add frames that define the direction of the applied force of collision

As shown in the above image frames has been expanded in the dialogue to the right and click in + icon

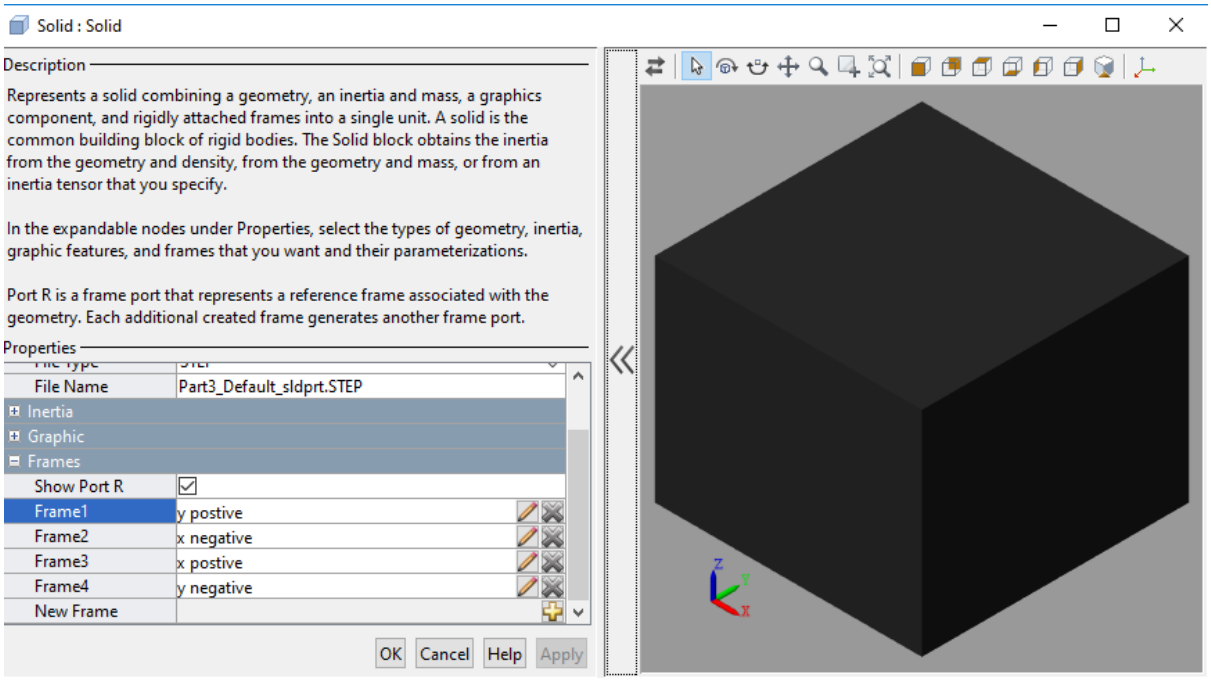
The below window will pop up. Here I define the frame at centre of the mass and I select the direction of z+ in the direction of y+ of the main frame- we make that be tick on based on geometric feature then on the box click on the plane or edge that face the direction of y+ of main frame ,, from this we call this frame y positive – illustration that the z+ of the new frame is in the direction of the y+ of main frame -. The main frame can be viewed in the left bottom of the cube as show in the below image.



After that we click in save button. Then we add another frame at the centre of the mass and make the direction of z+ in the direction of x- of main frame. Here there is some conflict happened between x and z of the new frame. To skip this we have to identify first x then z as shown in the below image. You can see primary and secondary axis has been defined based on the geometric feature

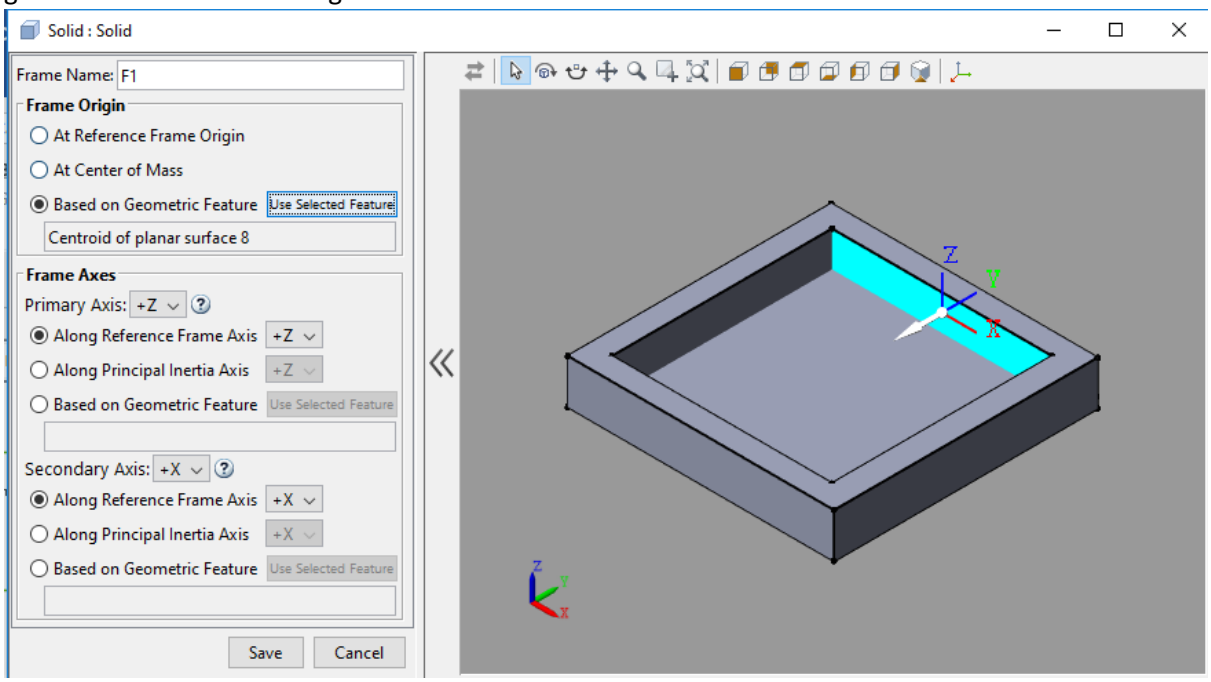


We repeat the above procedure with the other directions. Finally we get with the following frames as shown below

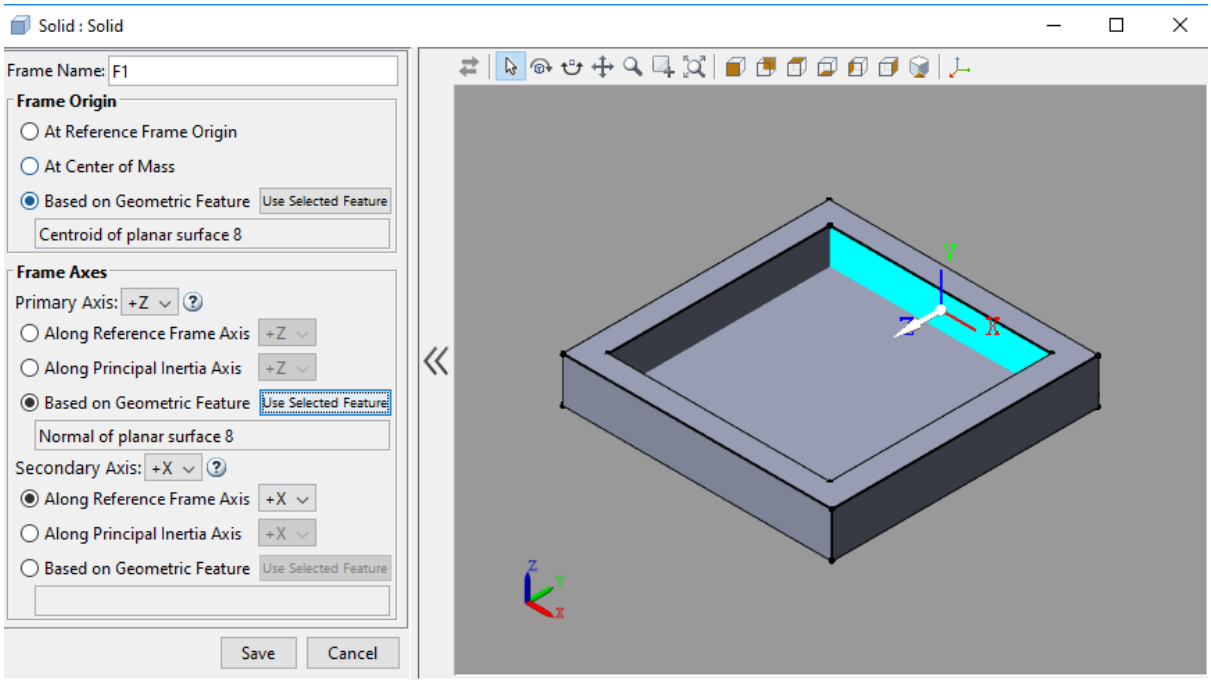


Then I go to the next object and define 4 different frames too with the same convection

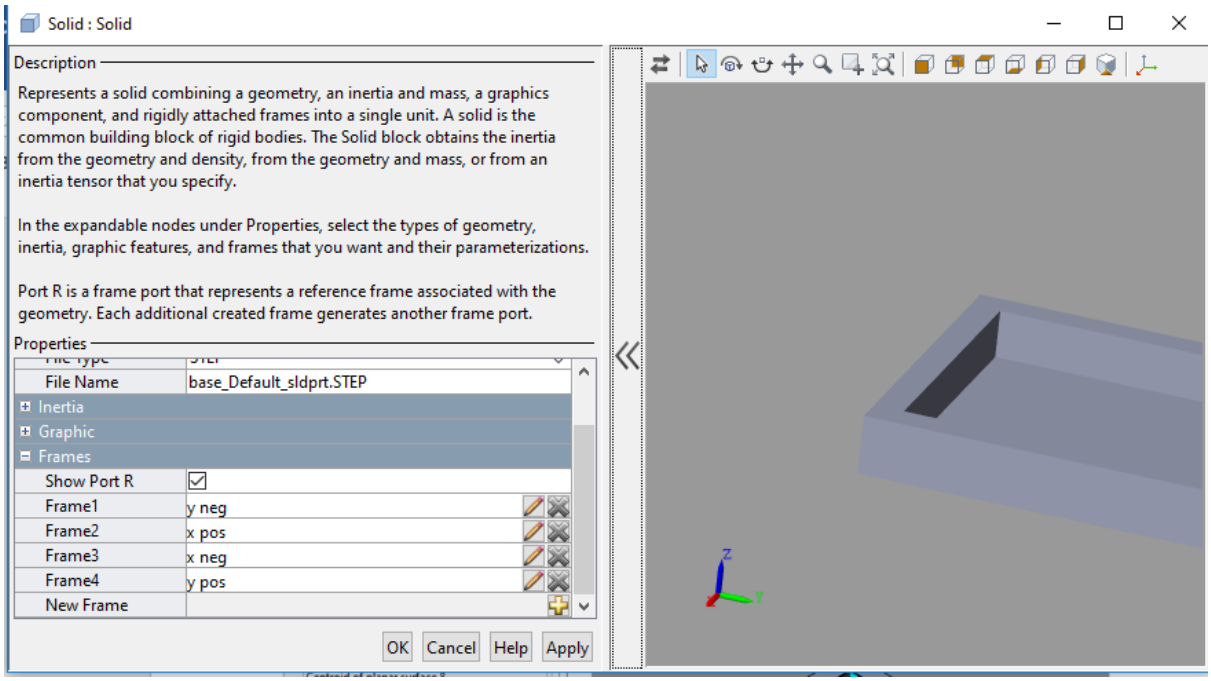
Making the frame at the centre of the inner edge of the wall we define it by using based on geometric feature. The image below illustrate that -



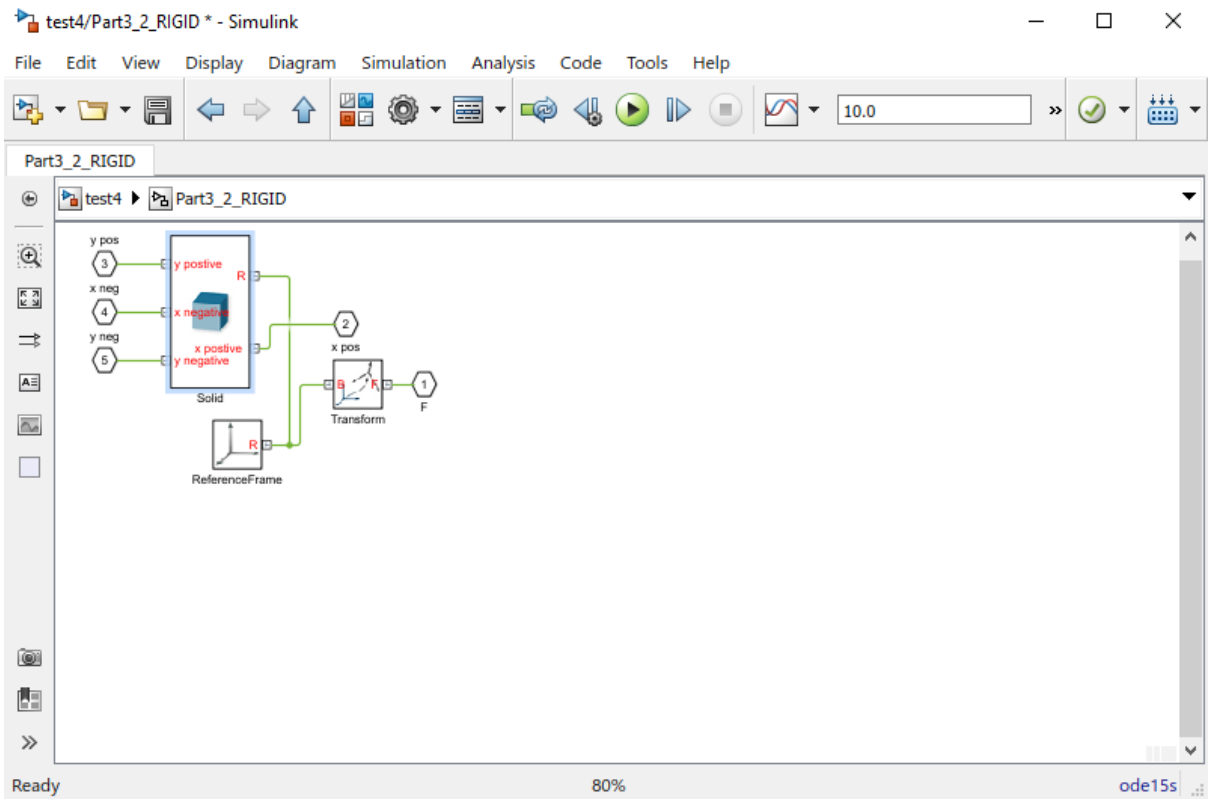
Then as we have done with cube, we make the z+ direction of the new corresponded to the y-direction of the main frame. The below image illustrates that



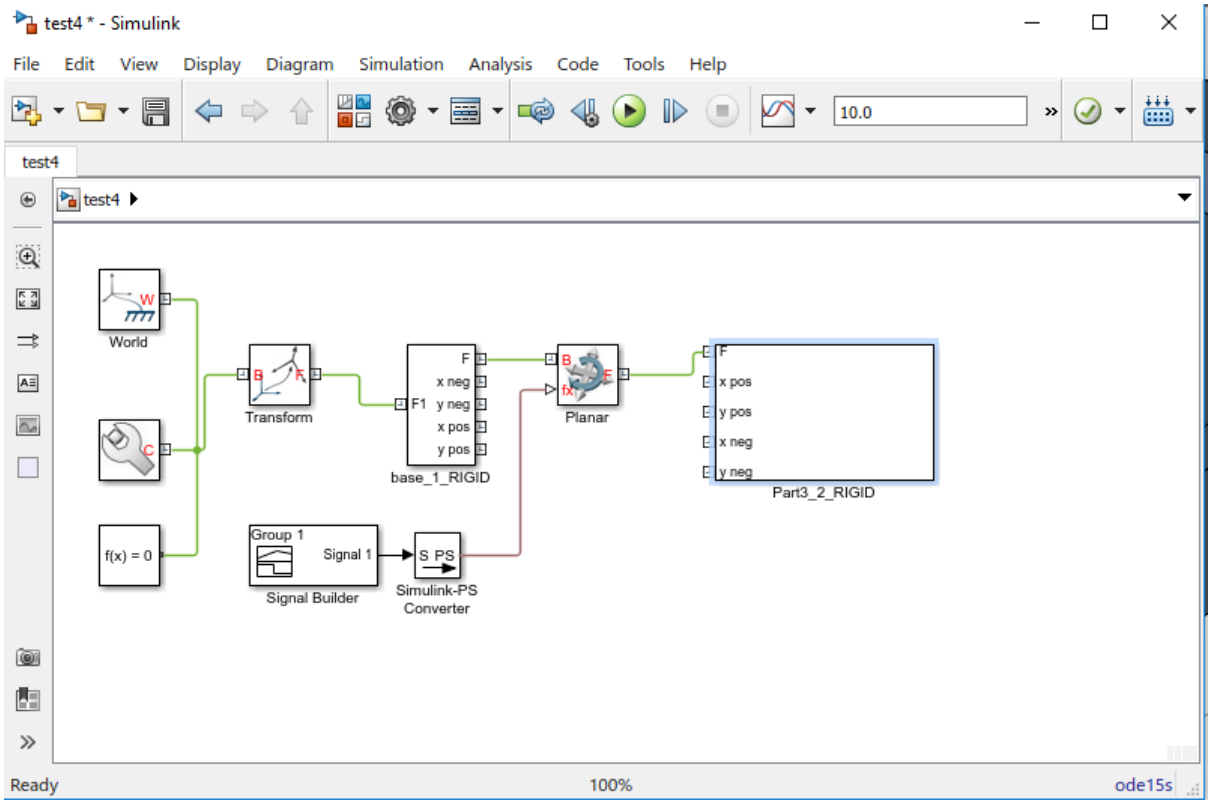
We repeat this procedure with the other edges of the wall. Finally we get with the following frames



The box and wall has been put in subsystems to make the new frames appears outside the the subsystem we need to add “connection” just copy and paste what is called F in the model and connect the frames- at the edges of the solid to these connections , the image below illustrate that



The final shape of subsystems will be like- below image- this



Then we need to add a block called face to plane contact force. Its documentation and how to use it is illustrated below

Web Browser - Face to Plane Contact Force (3D)

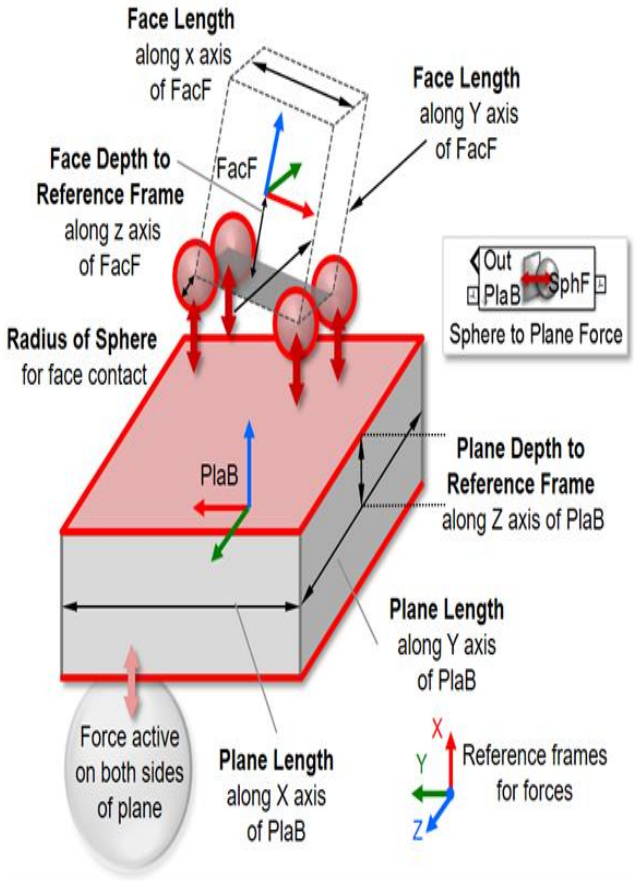
Face to Plane Contact Force (3D)

Location: //C:/Users/eezec/OneDrive/Documents/MATLAB/Add-Ons/Collections/Robot%20Arm%20with%20Conveyor%20Belts/code/Robot_Arm_Belts_R17a/Libraries/CFL_Libs/Libraries/Help/html/Face_to_Plane_Co

Face to Plane Contact Force (3D)

This subsystem implements a contact force between a plane and a square face. The plane is assumed significantly larger than the face such that the edges will never intersect. The force is active above and below the plane and face.

This is part of the Simscape Multibody Contact Forces Library



Frame connected to PlaB port:

1. Located at midpoint of plane (x, y, and z).
2. Z-axis is normal to the surfaces where force is active.

Frame connected to the FacF port:

1. Located at midpoint of box (x, y, and z).
2. Z-axis is normal to the surfaces where force is active.

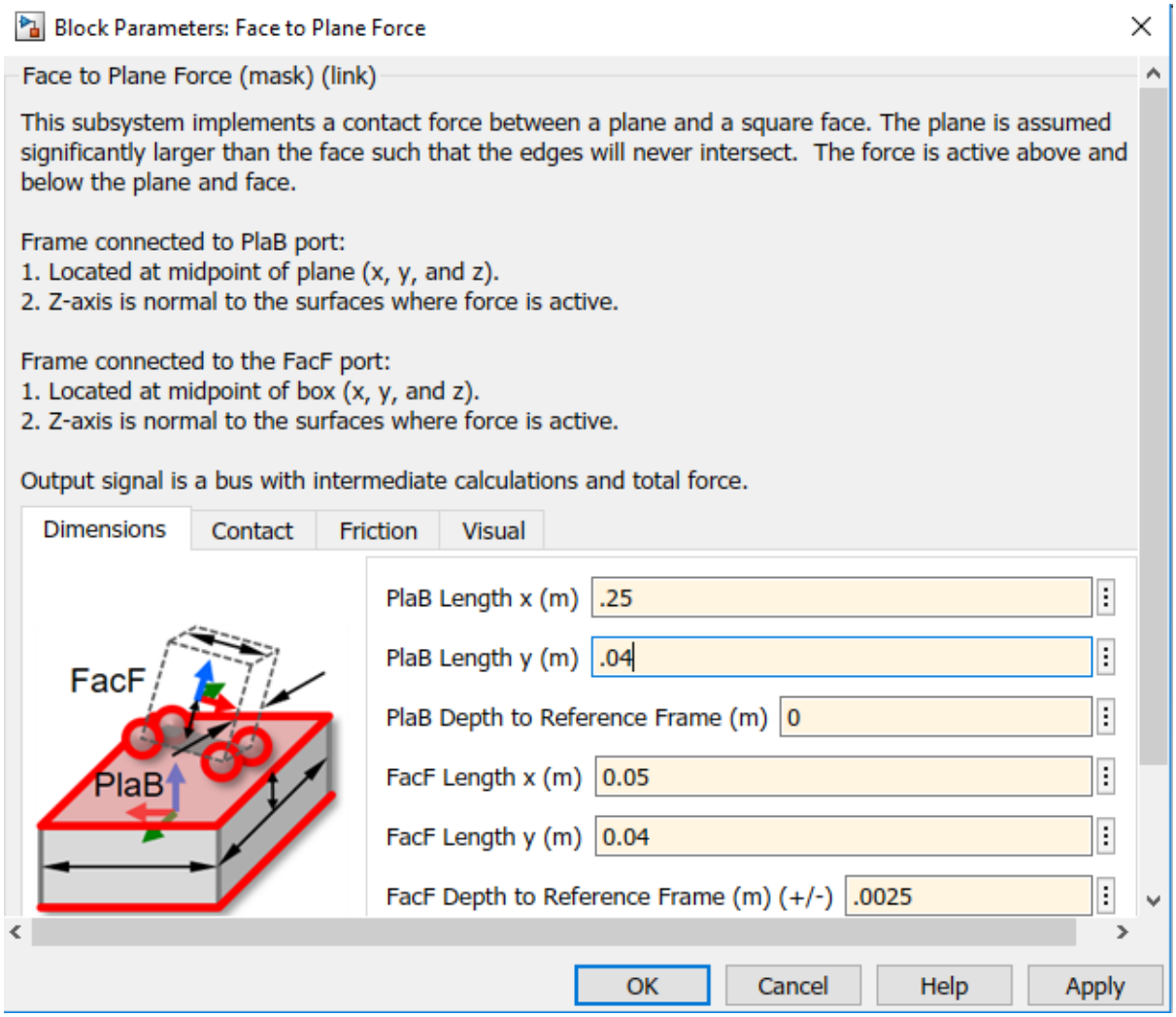
Output signal is a bus with intermediate calculations and total force.

The whole frames we have defined so far was according to the above documentation in order to use this block of contact force .

Now double click on the block the below pop up window will appeared. Now have a fast look at the first image of the dimension.

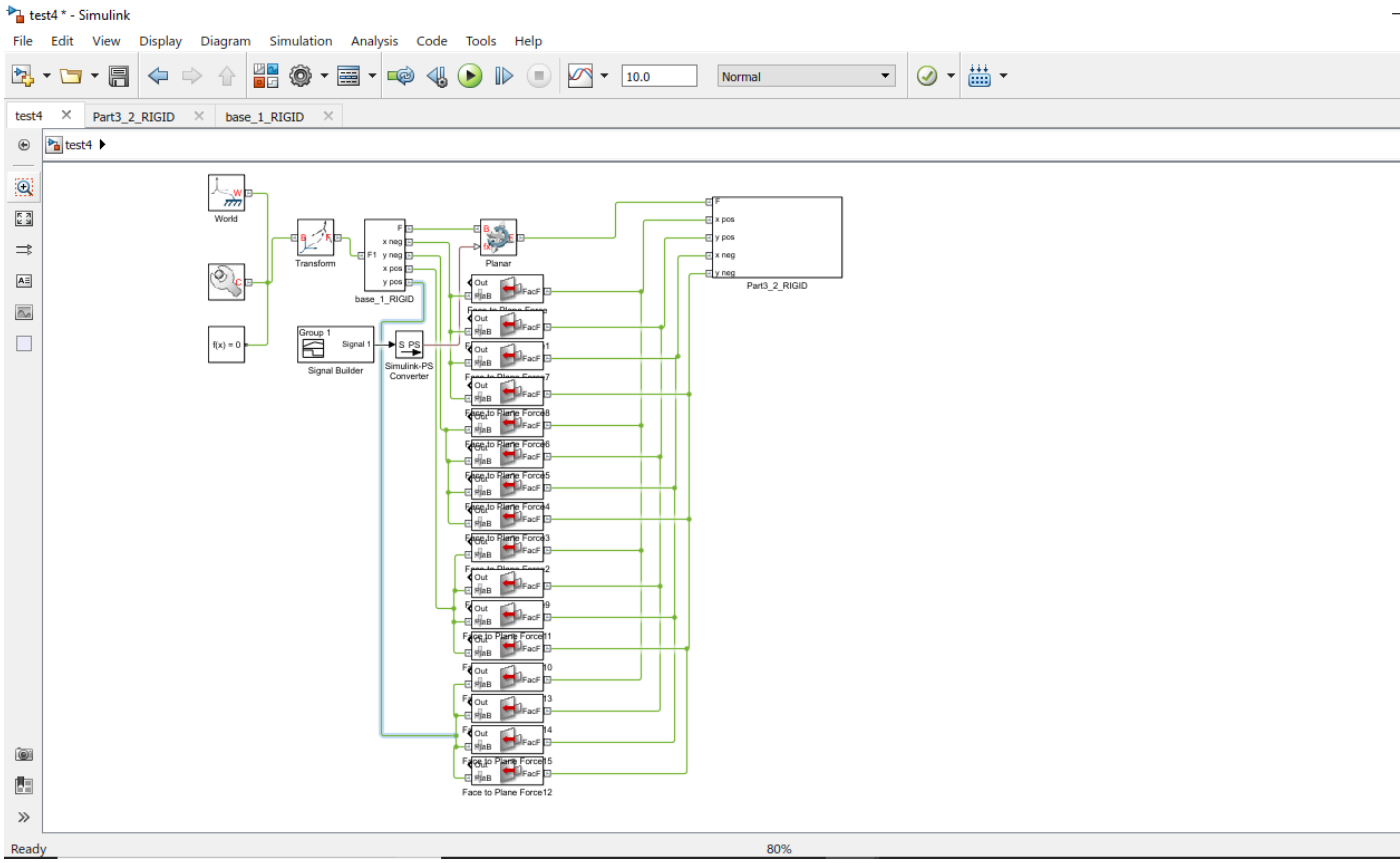
planB represent the wall , facF represent the cube. I defined the values of planB and facF according to the x, y direction of frame I create above

ps: the dimension in soild work was in millimetre. In MATLAB we use meter. The dimensions are illustrate below then I click ok



Then I just copy paste the block since the wall and cube is fixed and symmetric

I copy it about 16 times – 4 edges in the cube and 4 wall – each wall connect to the 4 edges as below


test4 * - Simulink
File Edit View Display Diagram Simulation Analysis Code Tools Help
10.0
Normal
test4
Part3_2_RIGID
base_1_RIGID
World
Transform
base_1_RIGID
Planar
Part3_2_RIGID
f(x) = 0
Group 1
Signal 1
Signal Builder
S_PS
Simulink-PS Converter
Face to Plane Force12
Ready
80%