# PART3: RELATIVE TRANSFORM COMPUTATION AND ALL VIEWS TRIANGULATION

## Relative Transform Computation

The task for this section is that we have to the relative rigid body transformations across all the 8 images. The following steps to be followed to accomplish the given task are as follows:

1) We have to compute the fundamental matrix using the first two images. With the help of it we compute the Essential matrix using the camera intrinsics.

F=K(-T)*R(T)*Sb*R*K
E=R(T)*Sb*R
F=K(-T)*E*K

2) In this step we would first decompose the Essential matrix with the help of *decomposeEssentialMatrix.m,* this function decomposes the Essential matrix into R,t pairs resolves their ambiguities and return the R,t pair for the images. This pair of R,t will be used to calculate the projection matrix.
x2 = K*[R | t]*X2
x2 = P*X2
therefore, P=K*[R | t]
as this will be for the second image it will be P2.

3) Now to see if it works correctly we use the function *algebraicTriangultion.m* this function takes the projected matrices of the images computed triangulate and plots the 3-d world image. We are taking two projection matrices P1=K*[I | 0] and P2=K*[R | t] and corresponding 2d image co-ordinates.

4) Now we will use the triangulated image from 1 and 2 to further calculate and other processes. Now there would be 56 3d points from the triangulated image of image 1 and 2 and 56 2d points for the image 3 which we computed in the first and seond assignment.

Now with the help of resection method and the formula for calculating the projection matrix we would calculate the projection matrix for the remaining set of images.

$P*X_i = x_i$

where, $X_i$ are the 3d points of the triangulated image and $x_i$ are the 2d points for the image from 3 to 8.

After using this equation we perform resecton method that is calculate the svd and get the projection matrix.

Results :

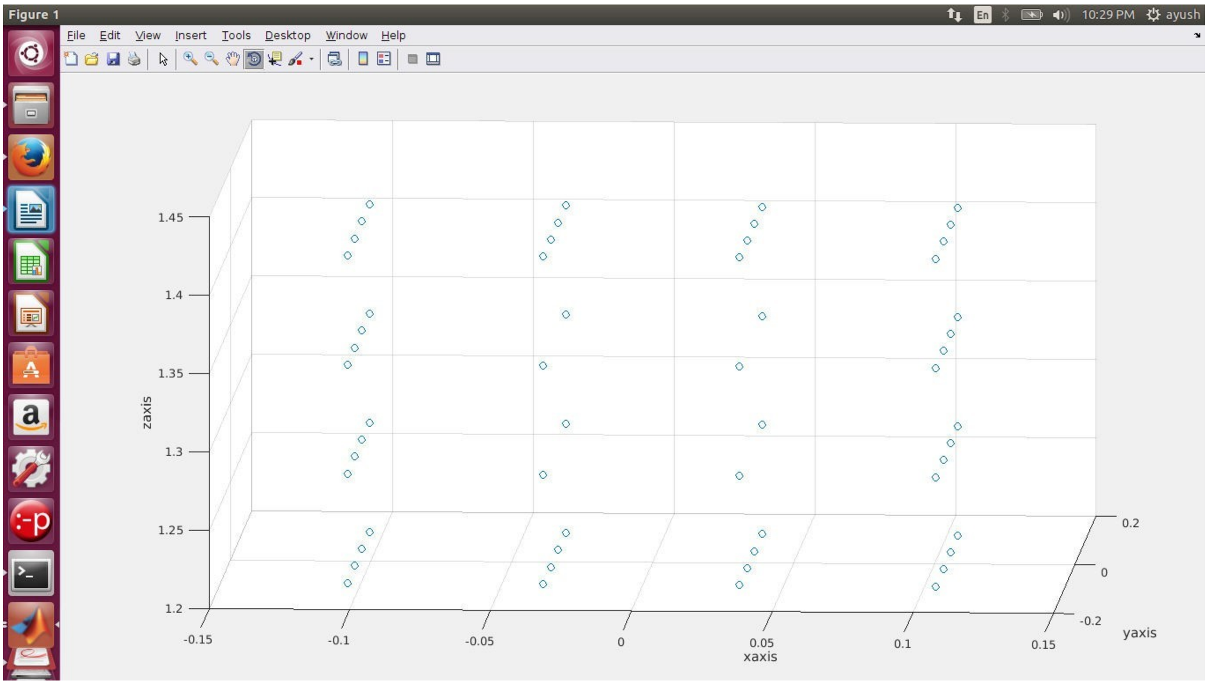



Image of triangulated cube, x-axis range:-0.15 to 0.15 z-axis range:1.45 to 1.25.

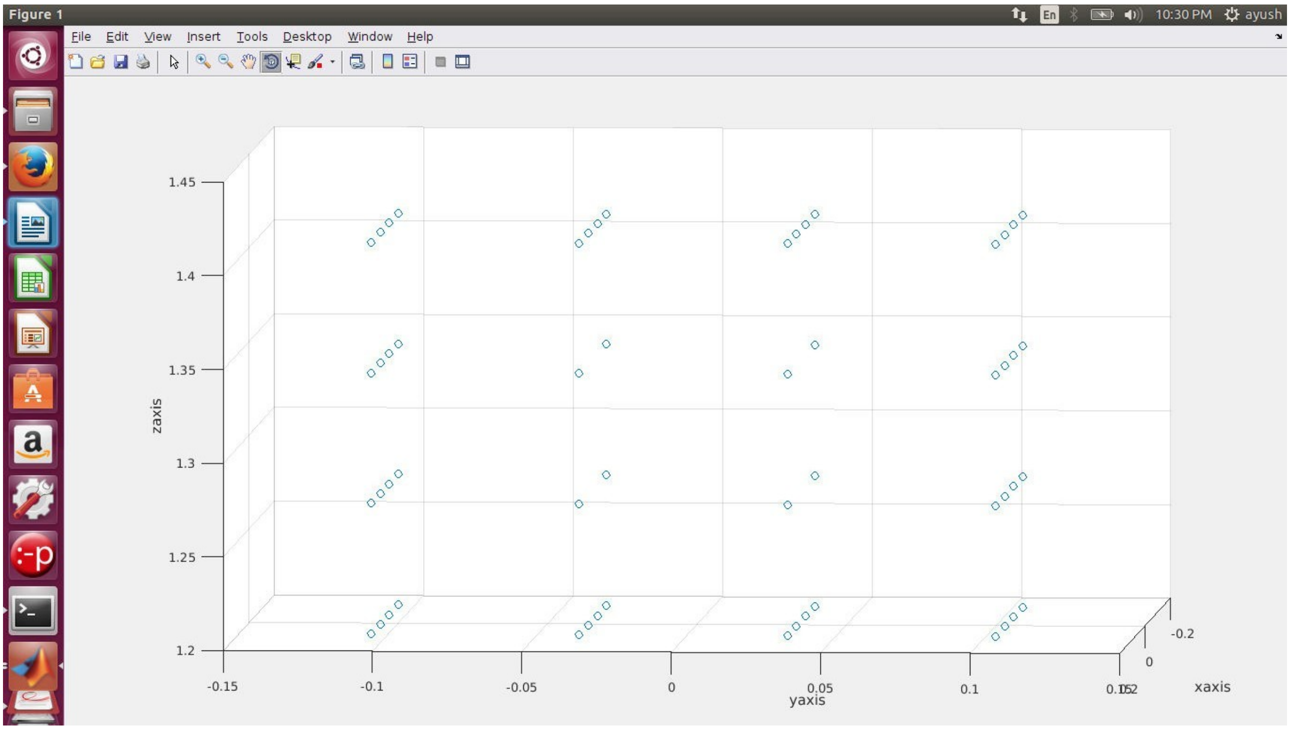
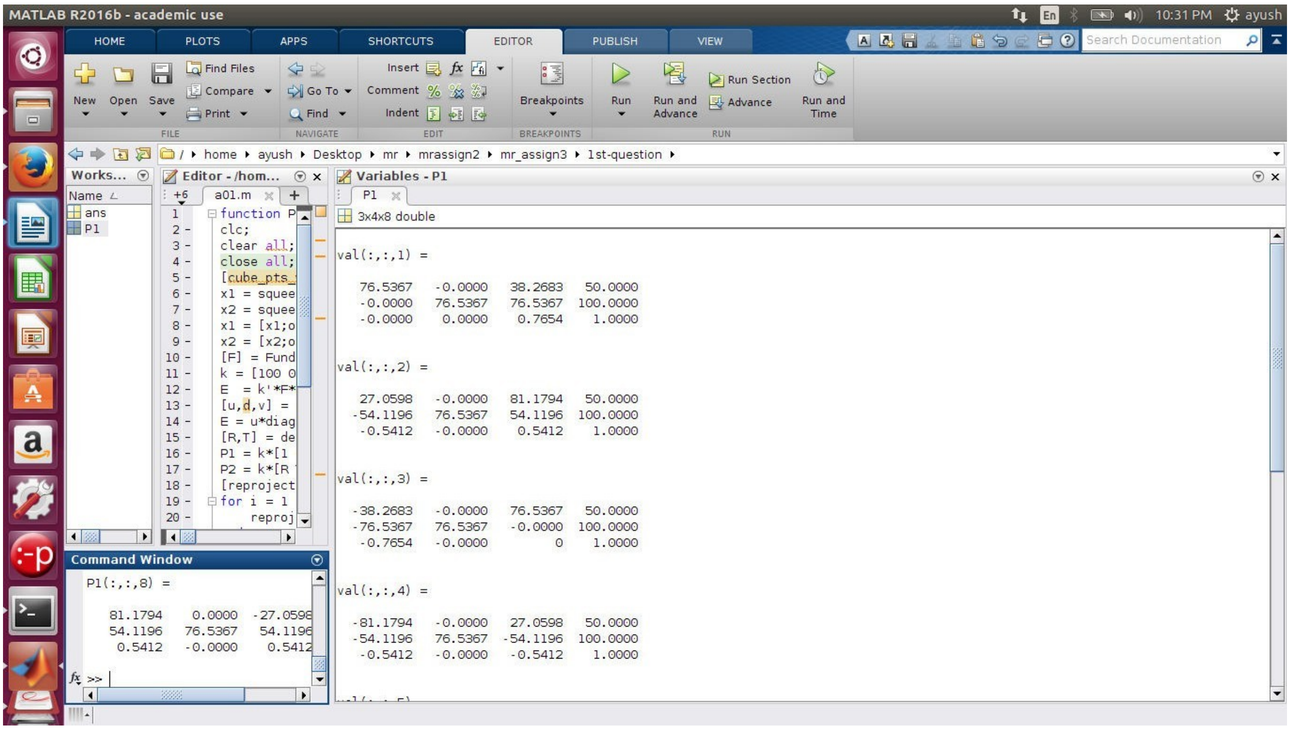
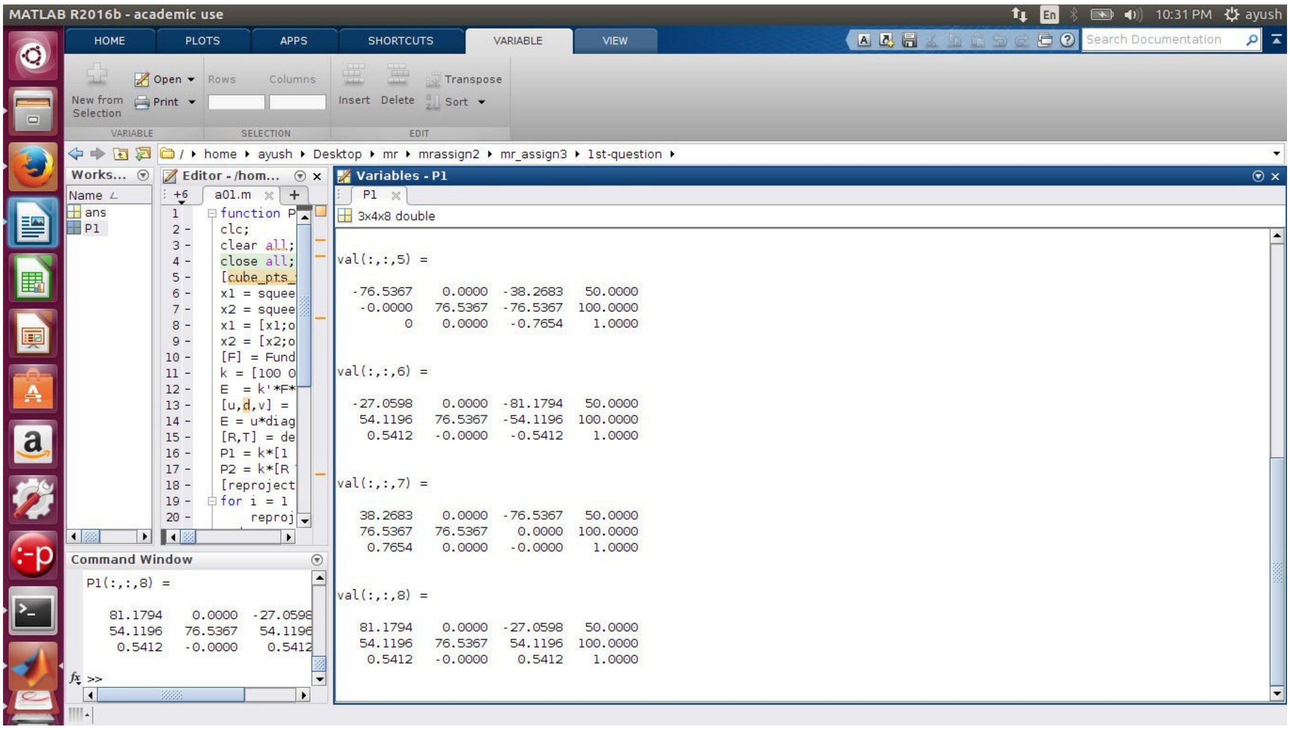



image of triangulated cube: yaxis range:-0.15 to 0.15



value of P matrix P1 to P4.




value of P matrix P5 to P8.

All views Triangulation

For this section what we have to do is that we computed the 3d points in the assignment 2 using the *algebraicTriangulation.m* which takes the projection matrix and 2d points and create the 3d points. Now we have to extend this script for 8 images i.e. we have to write to extend the script which should take all the images and the 2d points coordinate and compute the triangulated image which contains 56 3d points and we have to plot and see it.

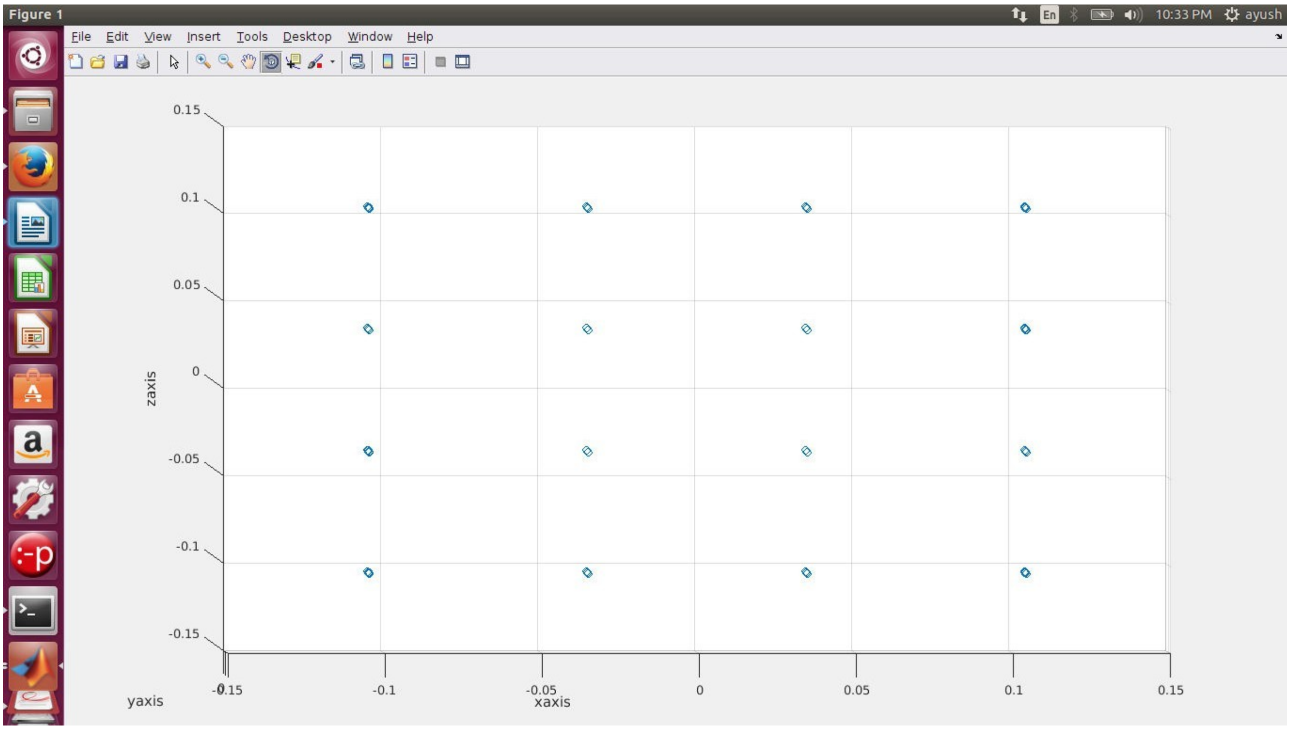
We extend the matrix A and then computing x by the equation Ax=b.

Also for a particular 3d point say X1 :

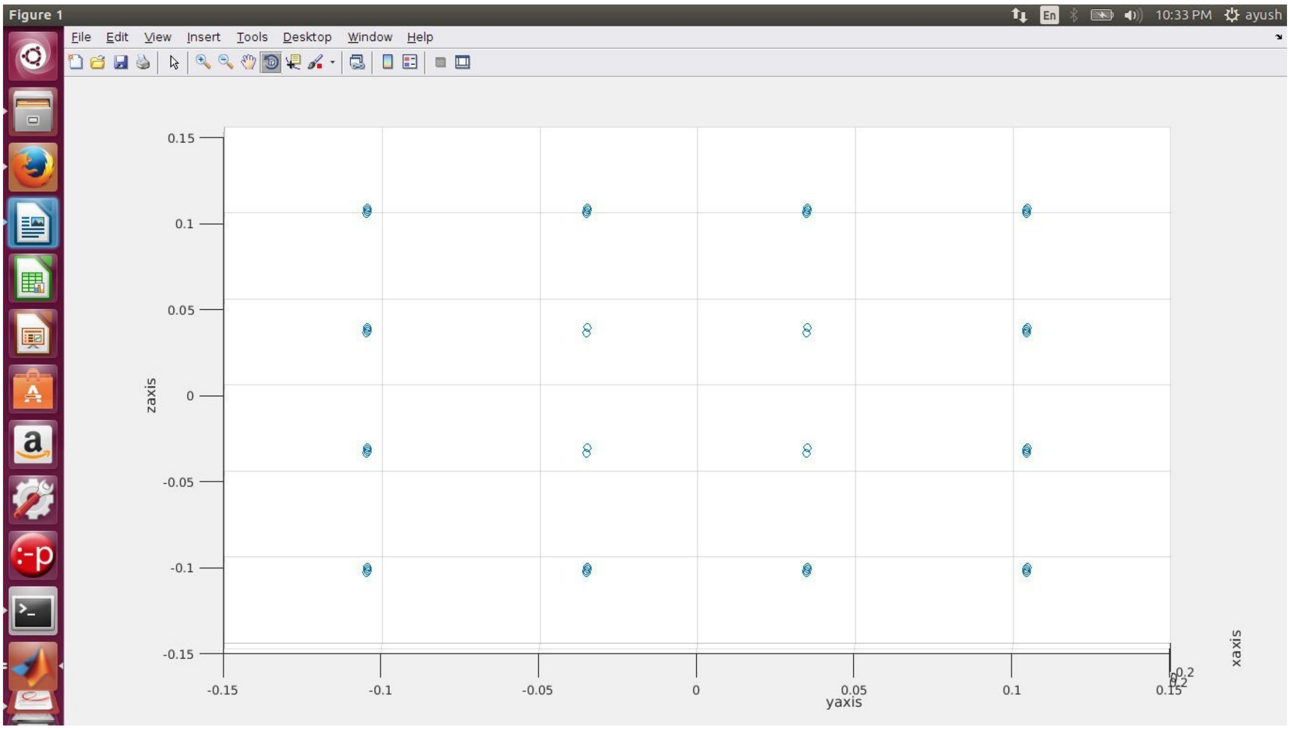
P1*X1=x11,P2*X1=x21,P3*X1=x31,P4*X1=x41,P5*X1=x51,
P6*X1=x61,P7*X1=x71,P8*X1=x81.

Where Pi are the projection matrix of ith image and xij are the 2d point for the ith image and jth point and Xj is the 3d point which would be computed by the extended script.

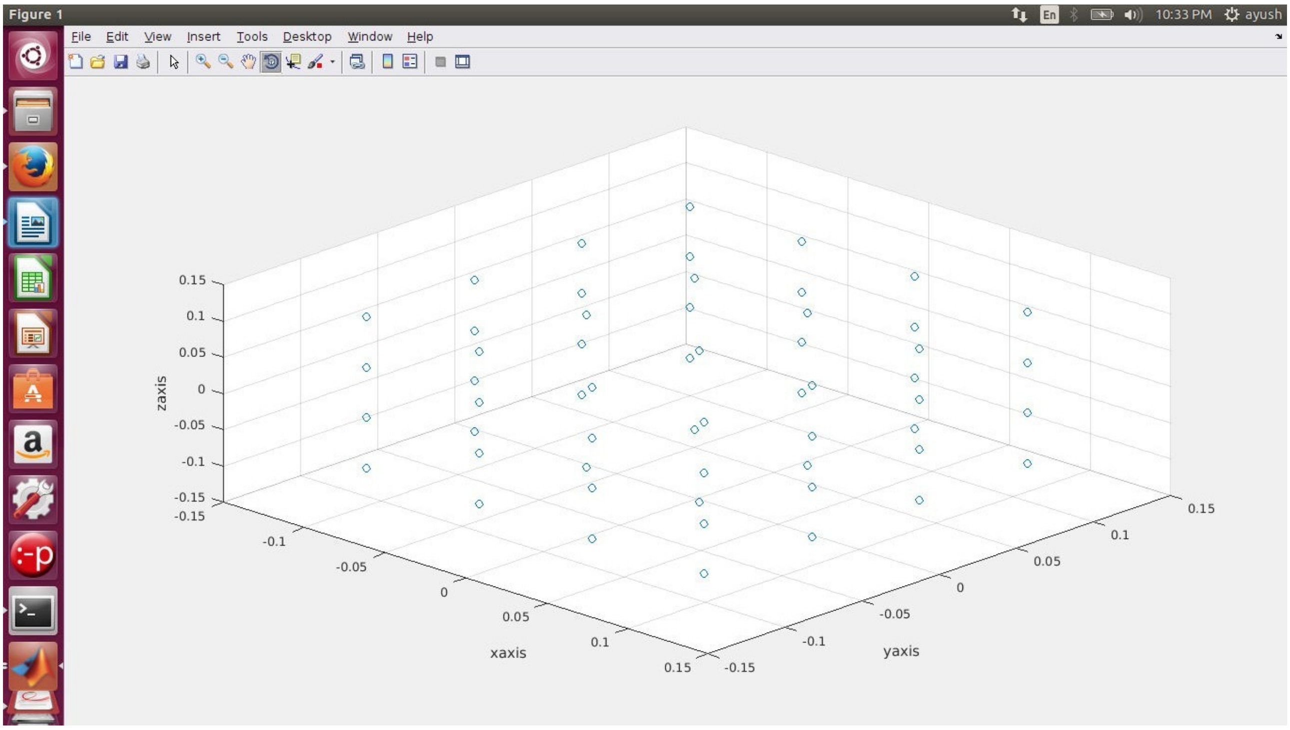
Results:



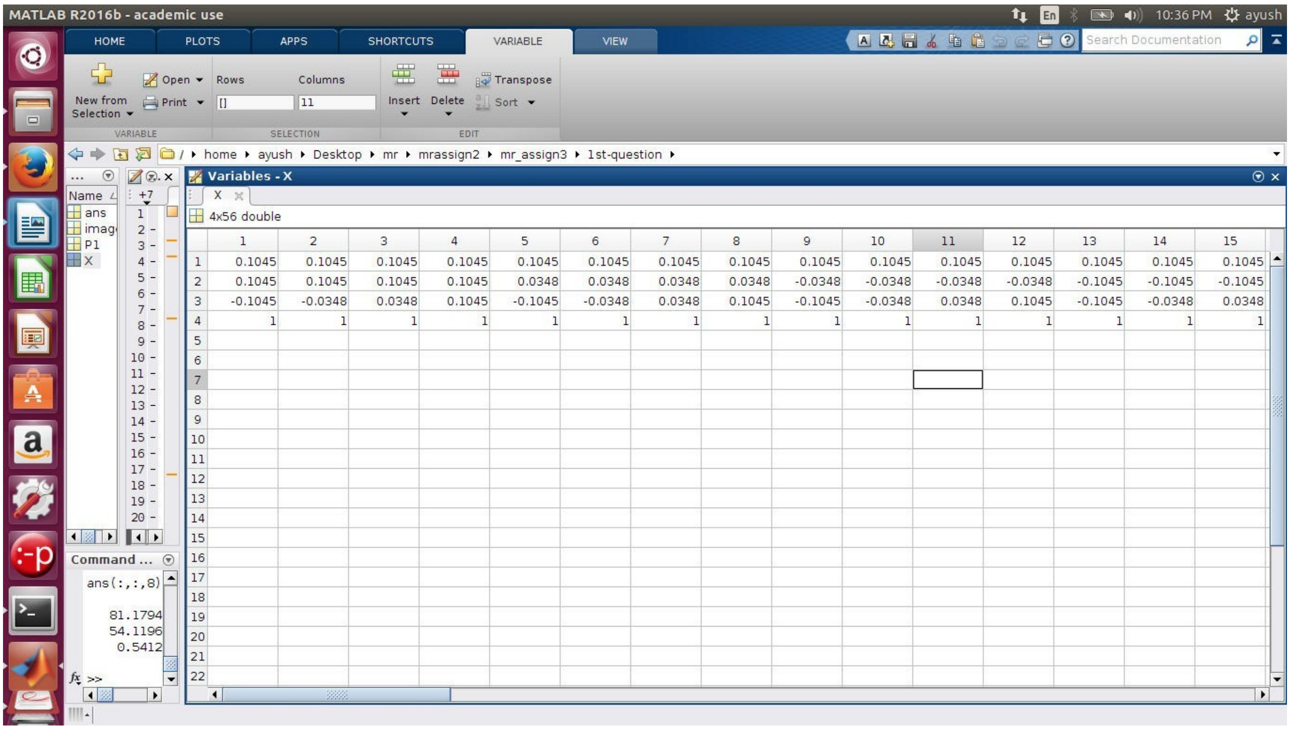

Triangulated cube, x-axis range: -0.15 to 0.15 z-aixs range:-0.15 to 0.15.




Triangulated Cube. Y-axis range: -0.15 to 0.15.




Triangulated Cube.




Triangulated 3d homogenous points values.