3D BAR DEMO

AIM:

Our aim for this tool is to create 3D objects like bars and bends. User can draw multiple bars or multiple bends or multiple bars-bends structures at different angles.

SYSTEM REQUIREMENTS:

To run this tool, user has to have **DirectX 9** installed in his system.
The system must be having at least **512 MB** RAM.
The screen resolution should be **1024 X 768 pixels**, and **17-inch** monitor should be used for the demo.

OVERVIEW:

There are certain command buttons on the application page like BAR, ANY ANGLE, 180 etc.

BAR: This button is used to draw a cylindrical bar.

ANY ANGLE: This button is used to draw arcs of any angle.

180: This button is used to draw an arc of 180 degree.

90: This button is used to draw an arc of 90 degree.

Likewise, user can draw arc of different angles.

VIEW POINT: This button is used to view the object from different viewpoints.

UNDO: This button is used to remove the last image.

REDO: This button is used to redraw the last image.

GO: This button is used to draw a particular object after specifying all of its parameters.

HOW TO DRAW DIFFERENT 3D OBJECTS:

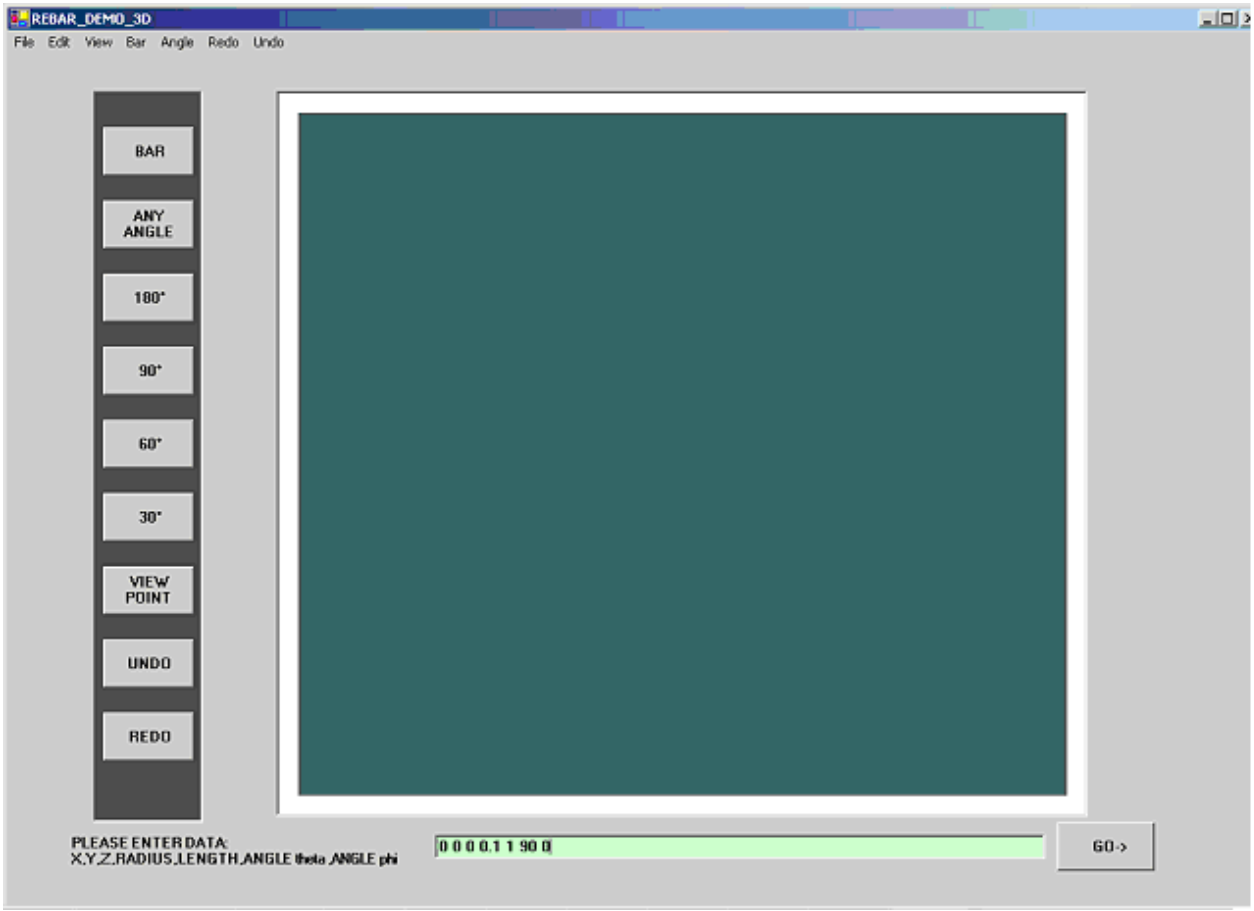
Simple bar in a single plane:

EXAMPLE 1

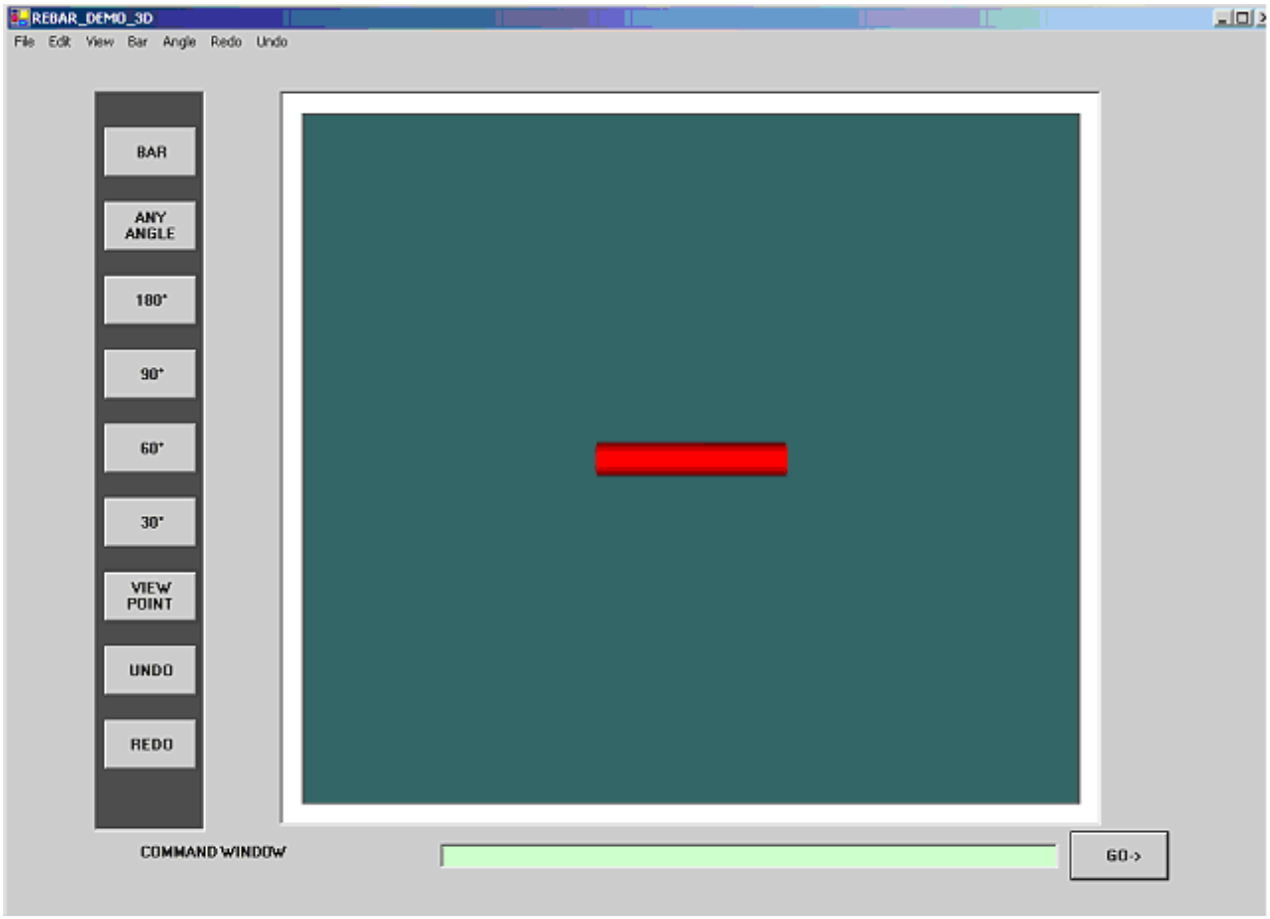
To draw simple bar, user needs to click on the button "BAR". Then on command window, all the specifications related to the bar will appear, like, X, Y, Z, Radius, Length, Angle theta, Angle phi.

X, Y, Z tell about the coordinates of the center of the rod.
Radius is the radius of the cylindrical bar.
Length is the length of the bar.
Angle theta is the clockwise angle from z-axis in the horizontal direction, i.e. along x-axis.
Angle phi is the clockwise angle from z-axis in the vertical direction, i.e. along y-axis.

After entering all the values, user will see the following screen image.



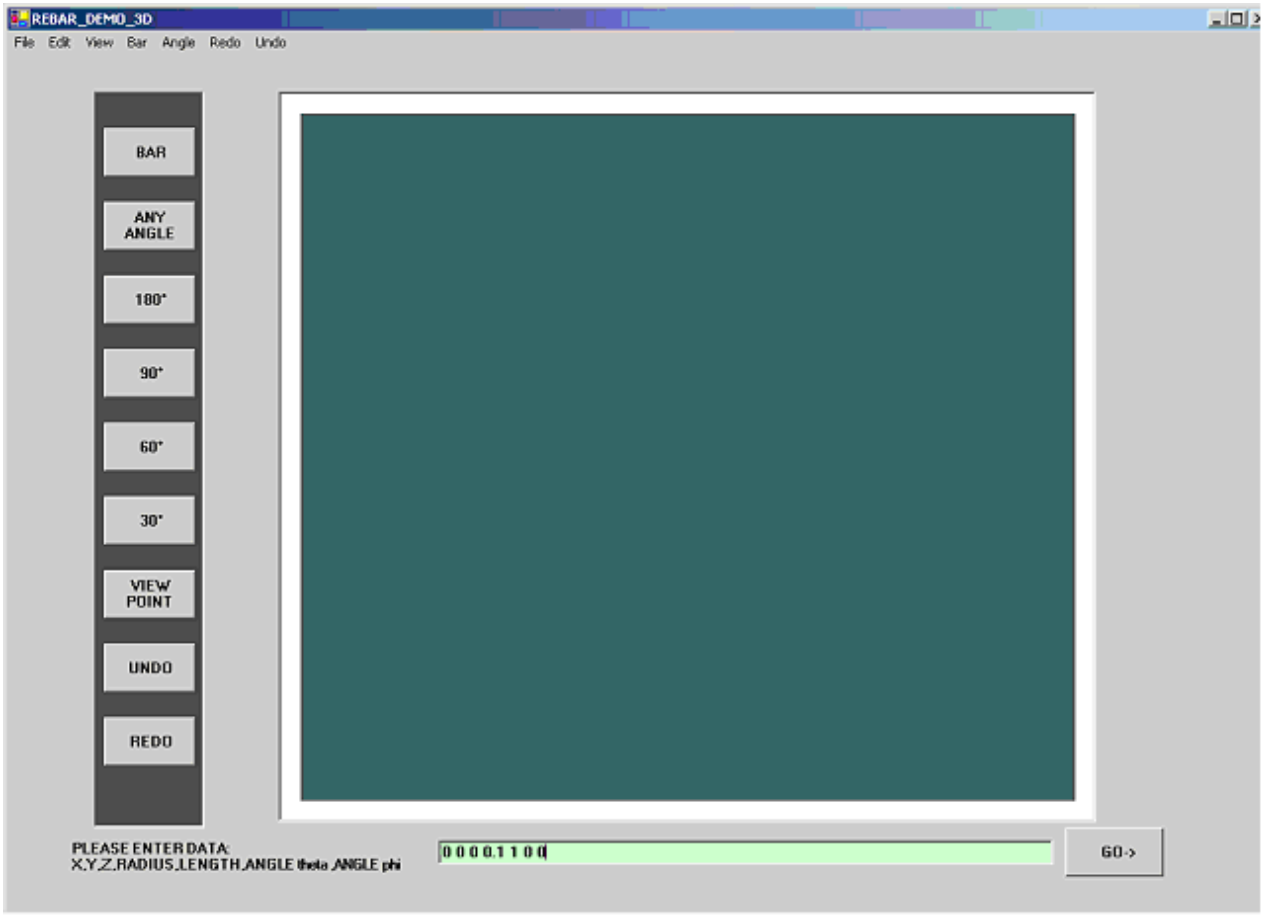
Now click on button “GO”. The bar will be drawn on the panel in XY plane.



The bars in different planes can also be drawn.

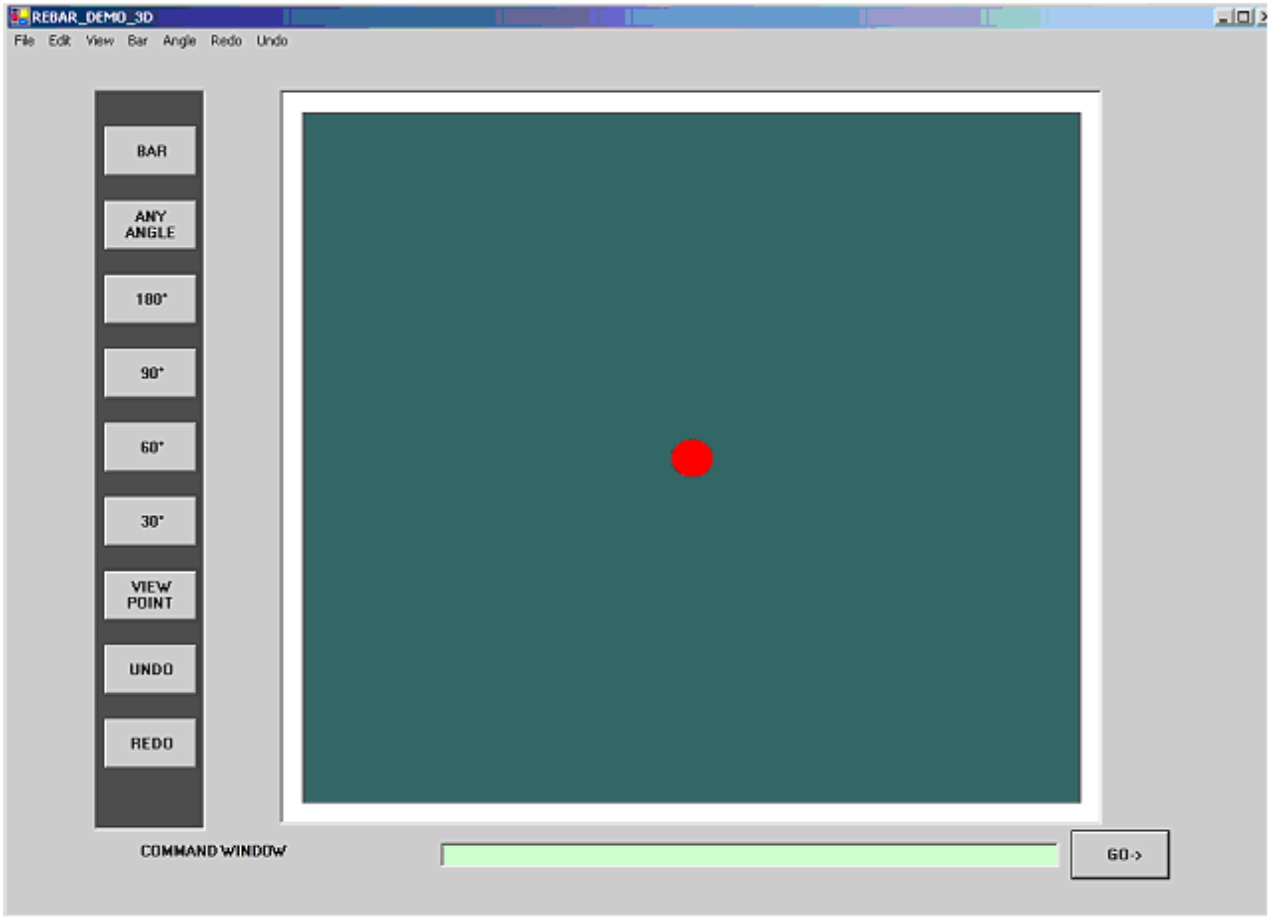
EXAMPLE 2

To draw bar in YZ plane, user needs to give the following parameters.



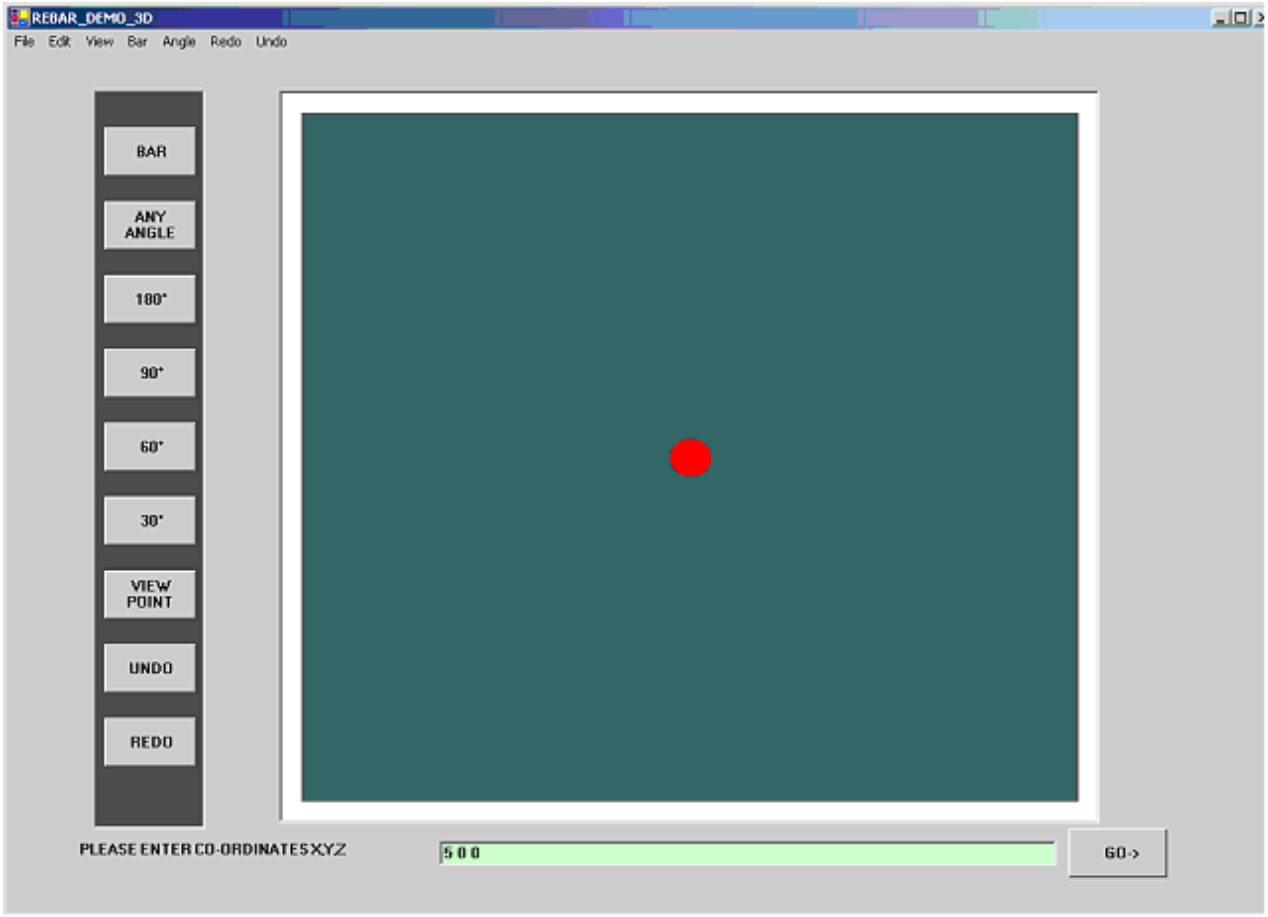
entering the parameters to draw the bar in YZ plane

After clicking on the button “GO”, following object will be drawn.

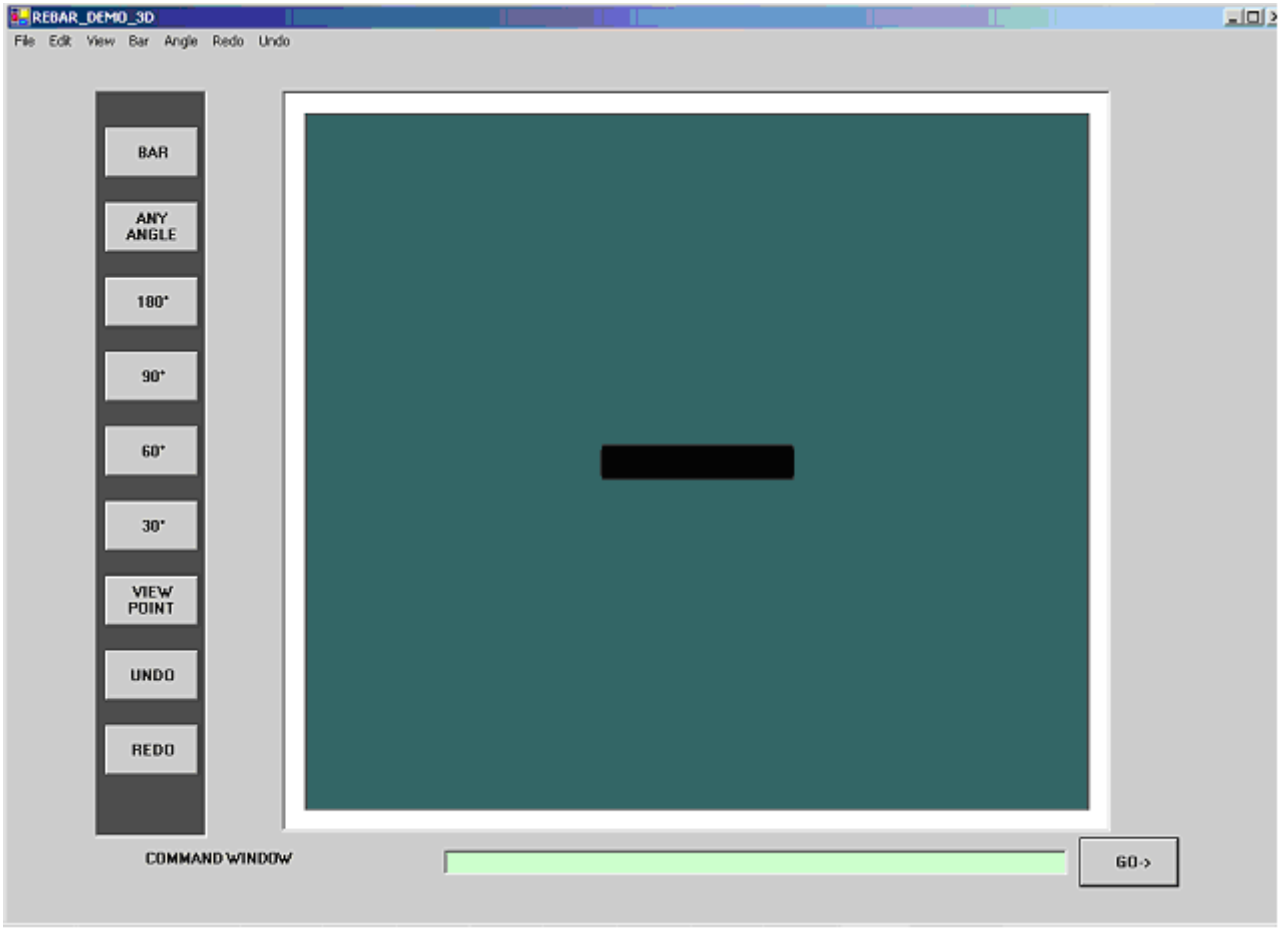


Our default view plane is YZ plane. We are viewing from (0,0,-5) which is in front of the screen of the monitor.

To change the view plane, user needs to click on the button “VIEW POINT”. After clicking on this button following picture will come on the screen.



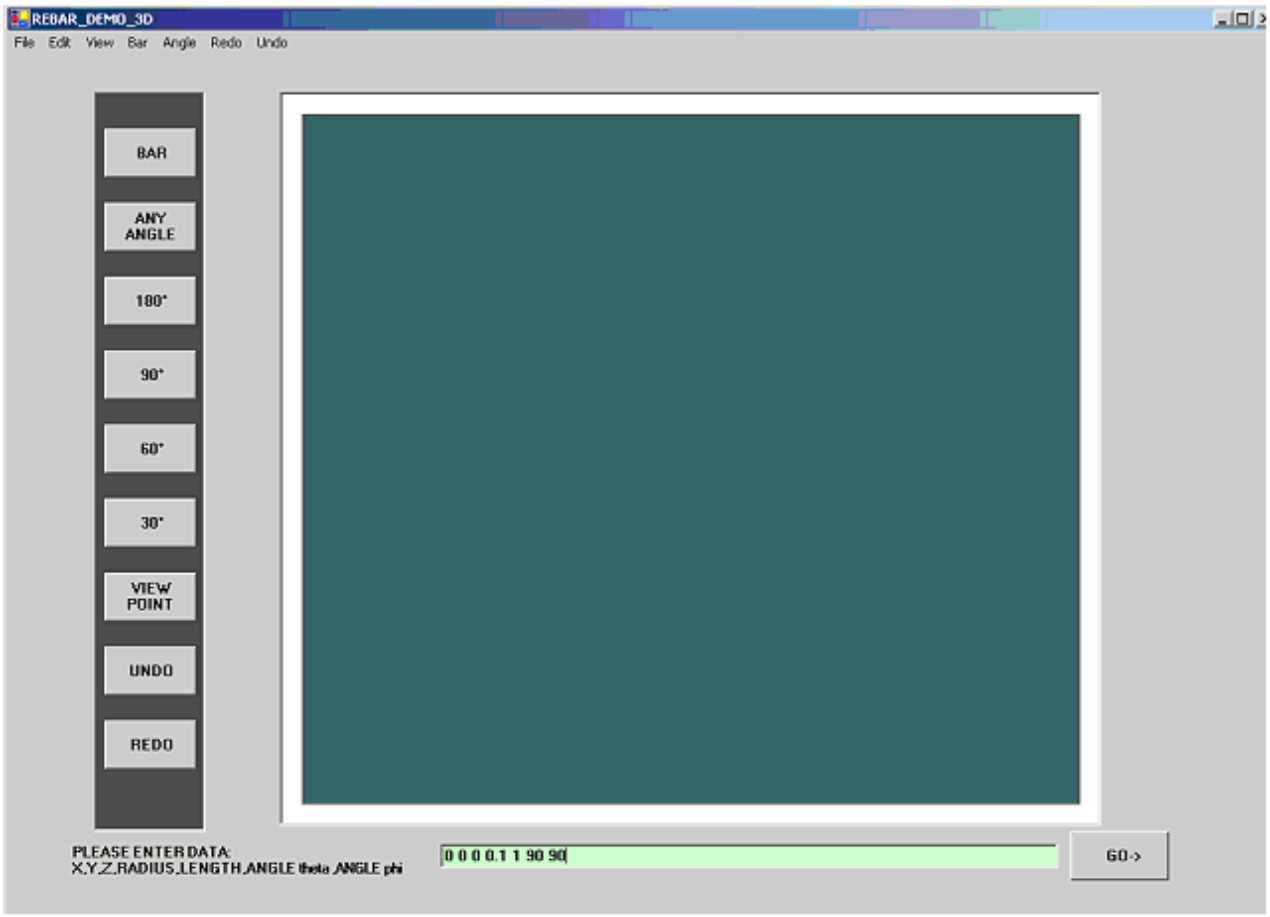
Again after clicking on button “GO”, the viewpoint of the viewer will be changed and the object will be seen from (5,0,0).



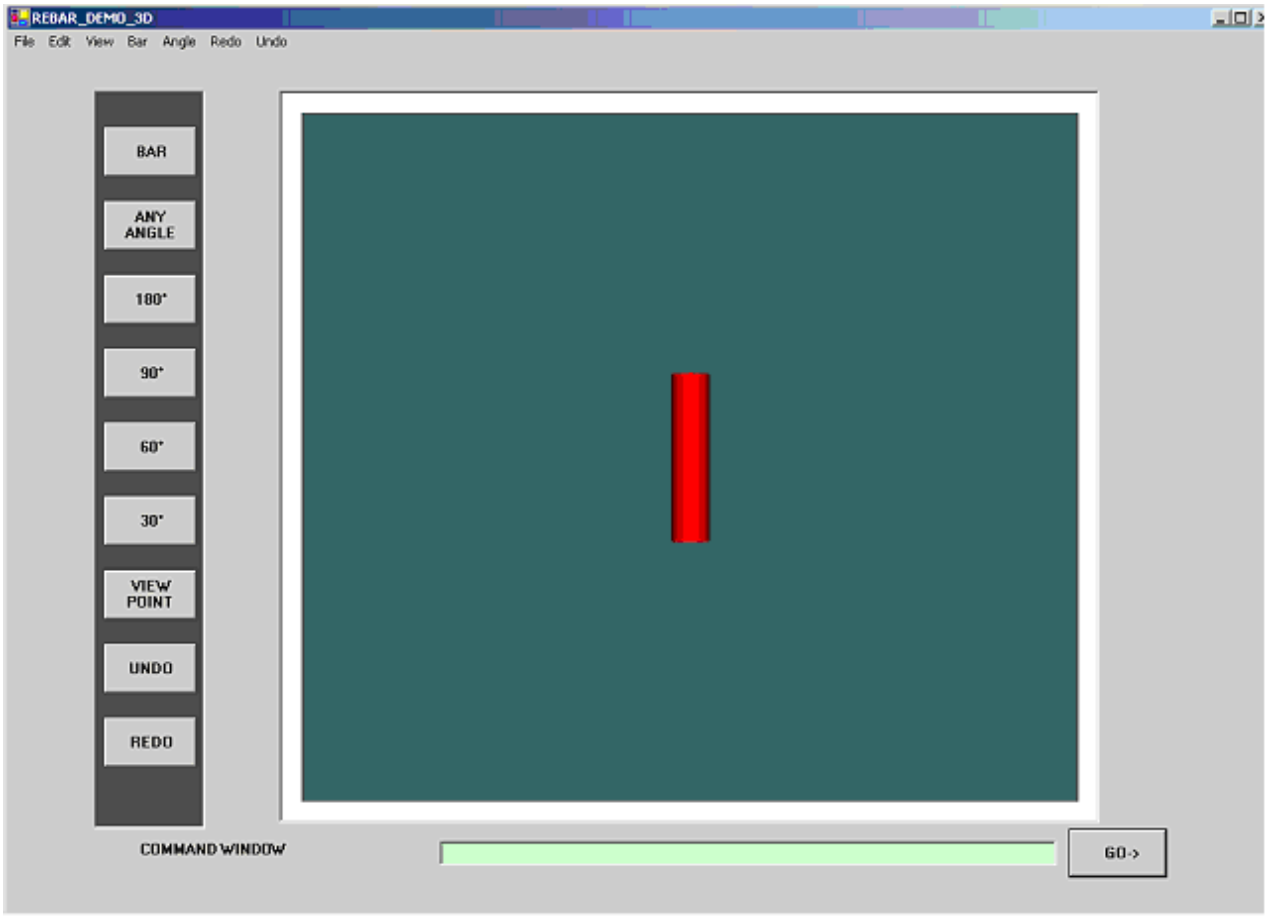
The bar is looking dark when user changes the viewpoint to the back of the screen. This issue is discussed later in this document.

EXAMPLE 3

Similarly, bar can be drawn in XZ plane.



After clicking on the button “GO”, following object will be drawn

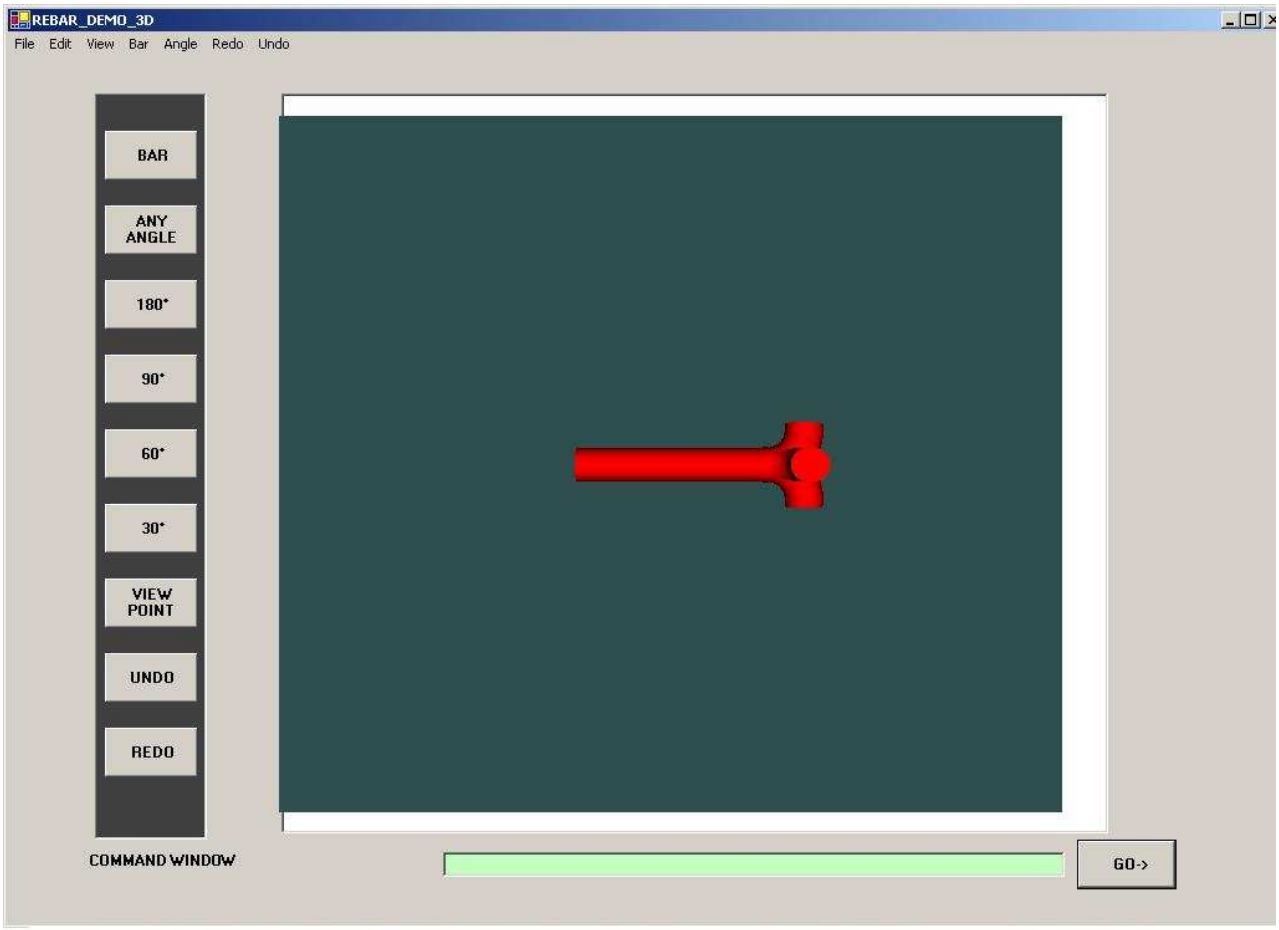


drawing the bar in XZ plane

User can view it from different viewpoints as we have seen in the earlier case.

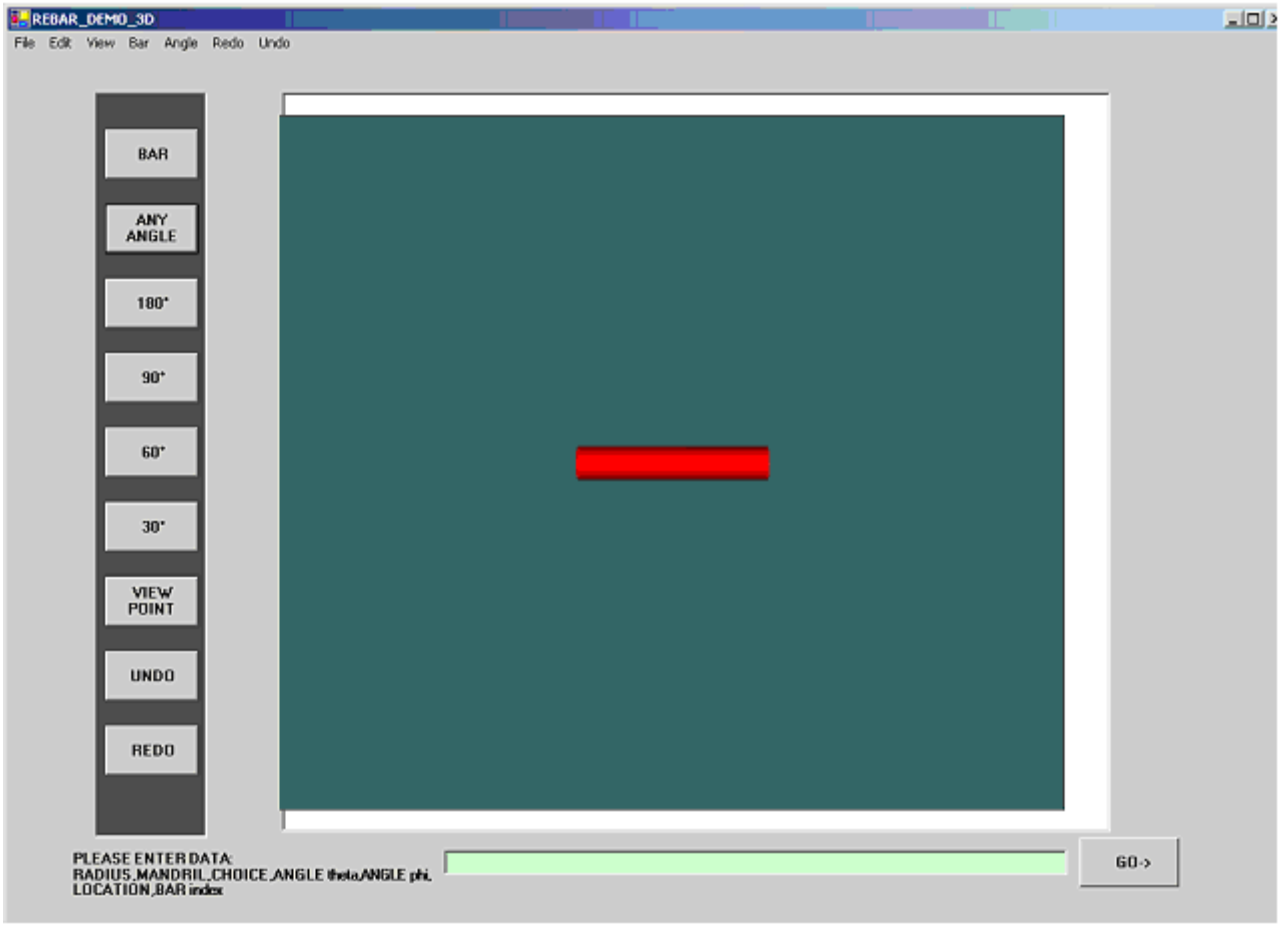
DRAWING BENDS IN 3D:

A bend or an arc can be drawn only after drawing a bar. User can add a bend at the ends of a bar. At any end of a bar four bends can be drawn. One in the up direction, one in the down direction, one in the front direction and one in the back direction. After drawing all the four arcs following object will be created. We can add these arcs at the other end also or at both ends at simultaneously.



drawing the bar with four arcs or bends at one of its ends

When user wants to draw a bend or an arc at the end of a bar, he/ she has to click on the button "ANY ANGLE". After clicking on any of the buttons, following image will be seen on the screen.



RADIUS: It is the radius of the cylindrical bar through which we want to attach a bend.

MANDRIL: It is the radius of the curve.

CHOICE: It is used to draw the bend on either sides of the bar. 1 is used to draw the bend on right side of the horizontal bar (upside of the vertical bar) and 2 is used to draw the bend on the left side of the horizontal bar (downside of the vertical bar).

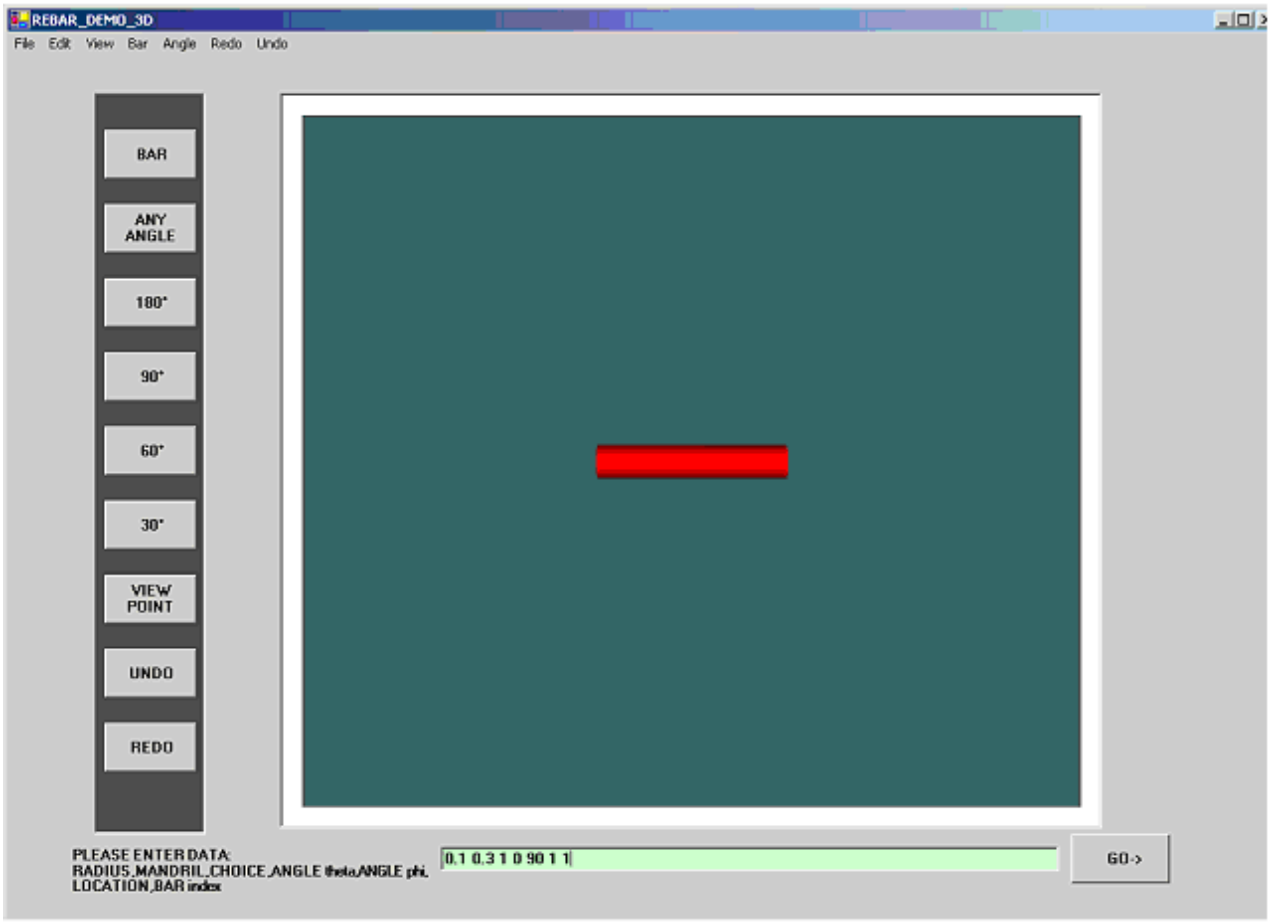
ANGLE theta & ANGLE phi: These are used to draw the bends in the different planes. If user wants to draw the bend in the plane of the screen i.e. in XY plane then he needs to mention only angle phi and if user wants to draw the bend in the plane perpendicular to the plane of the screen i.e. in the XZ plane then he needs to mention angle theta only.

LOCATION: It is used to draw the bends in all the four directions of the bar. 1 is used to draw the bend in down direction of the horizontal bar (left of the vertical bar). 2 is used to draw the bend in the up direction of the horizontal bar (right side of the vertical bar). 3 is used to draw the bend in the front direction of the horizontal as well as vertical bar. 4 is used to draw the bend in the back direction of the horizontal as well as vertical bar.

BAR index: It is used in multiple bends attached to a single bar. If user is drawing first bar at the end of a bar then its values is 1. if user is drawing second bar at any end of a bar the nits value is 2 and so on.

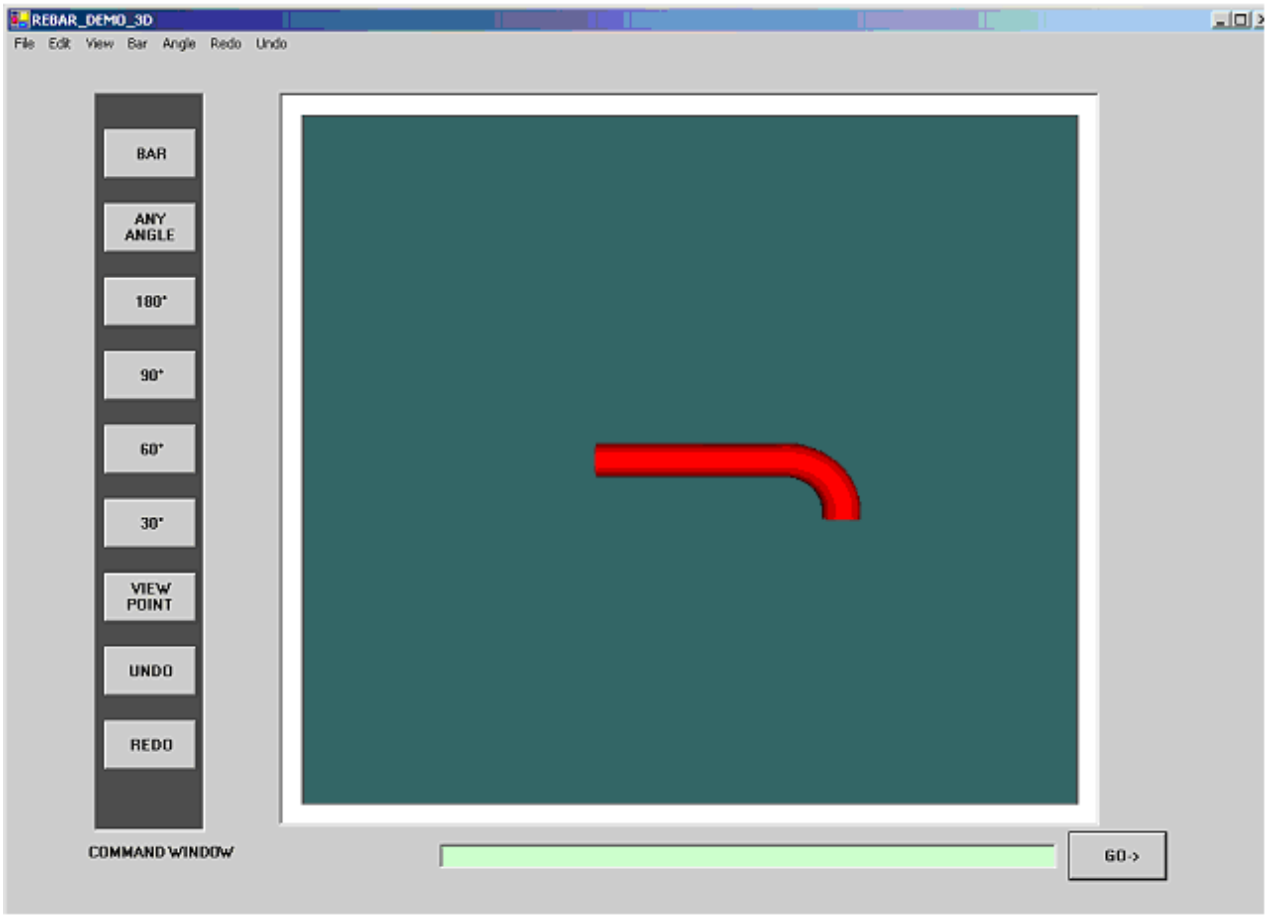
EXAMPLE 4

User has to enter all the values of these parameters to draw a bend. Following figure is showing certain values of the parameters.



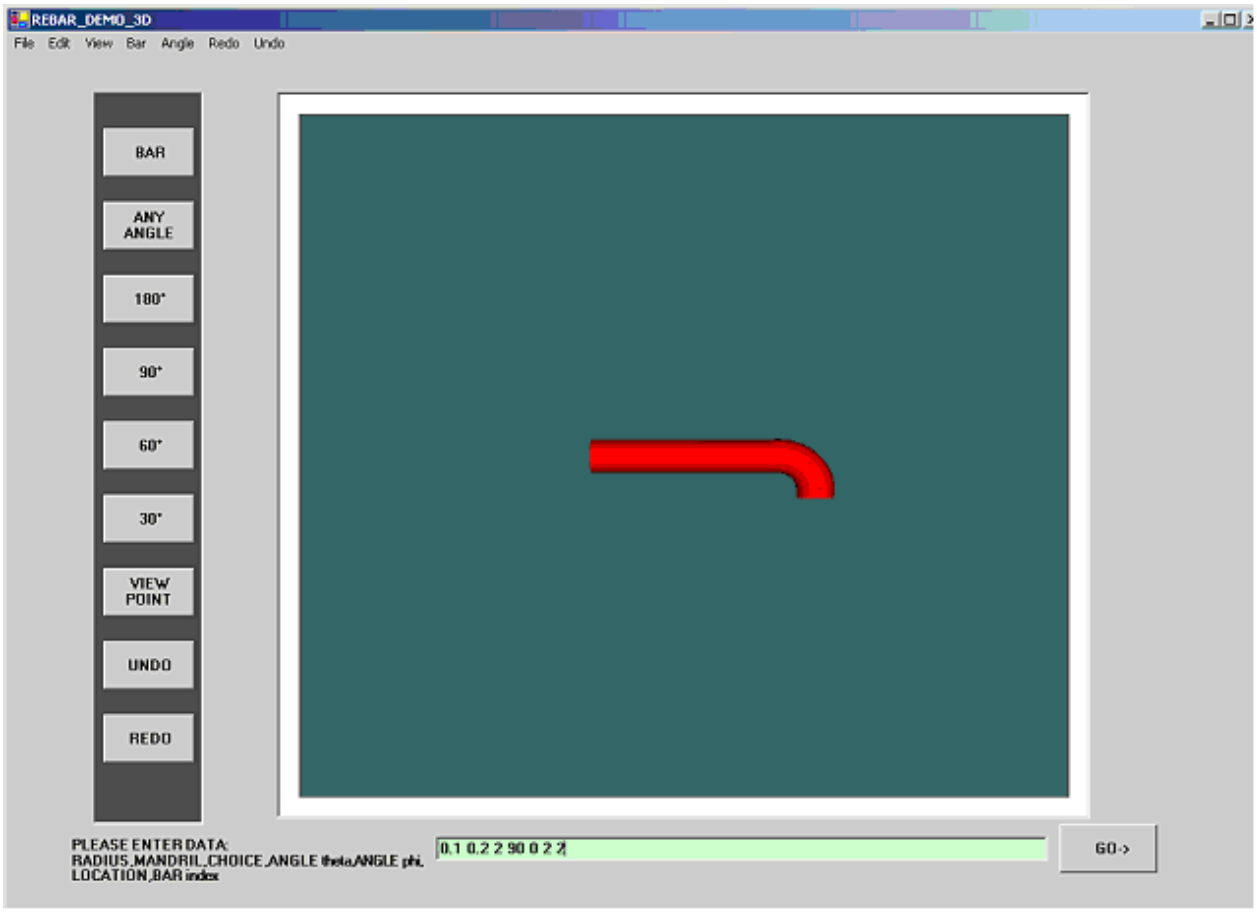
As per the given values, a 90 degree bend will be drawn in the XY plane (only angle phi is mentioned) and will be in the down direction of the bar (location =1) and at the right side of the bar (choice=1).

After clicking on the button “GO”, following figure will be drawn.



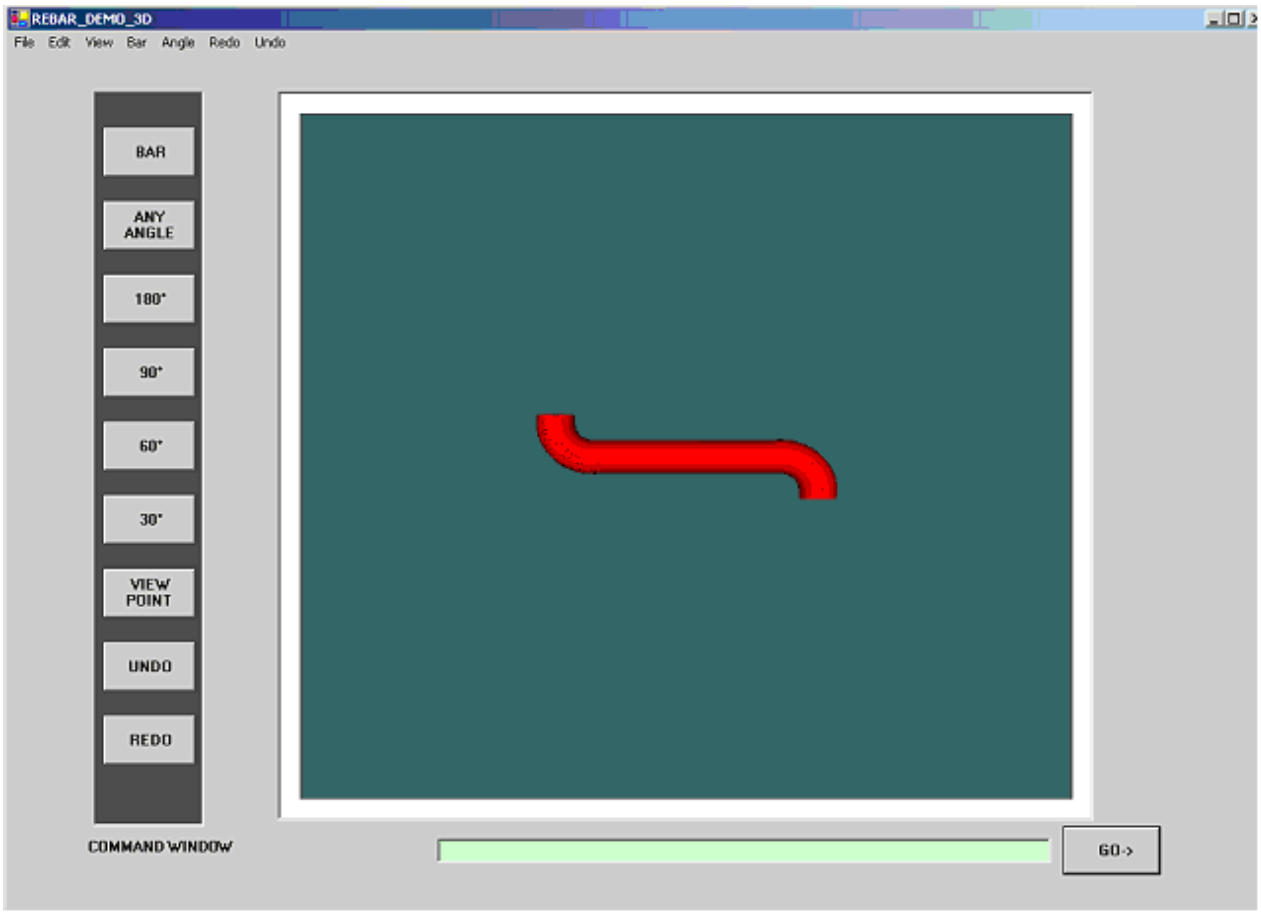
drawing a bend

User can add one more bend at the same end of the bar. He just needs to give bar index value equal to 2.



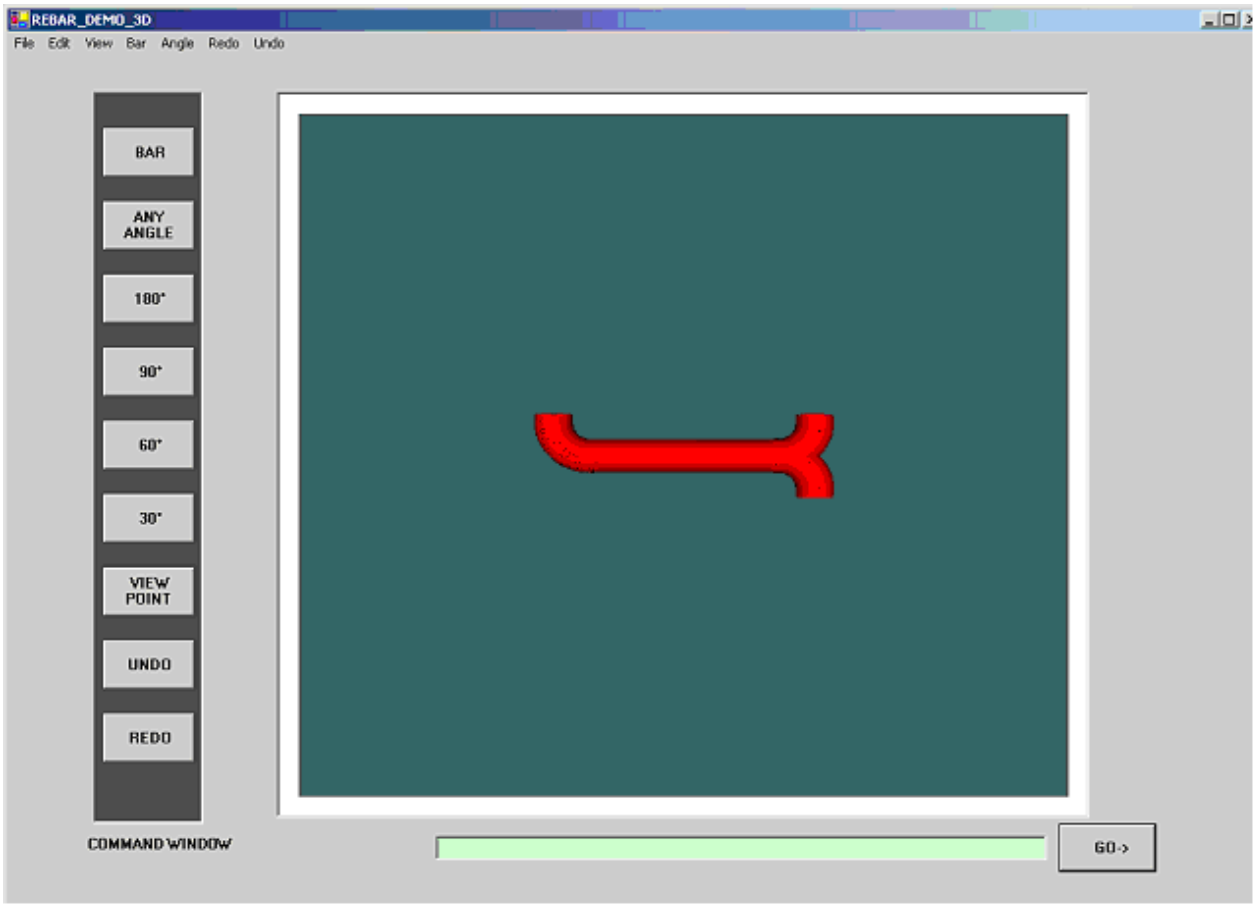
putting the value of BAR index as 2 and CHOICE as 2

It will add one more bend at the left end of the bar, since we have given the CHOICE as 2. The value of BAR index is given as 2 because the bar is the second last object. The value of BAR index decides where the user wants to add the bend. The bend will be drawn in the up direction since the value of LOCATION given is 2.



drawing the second bend at the end of the rod

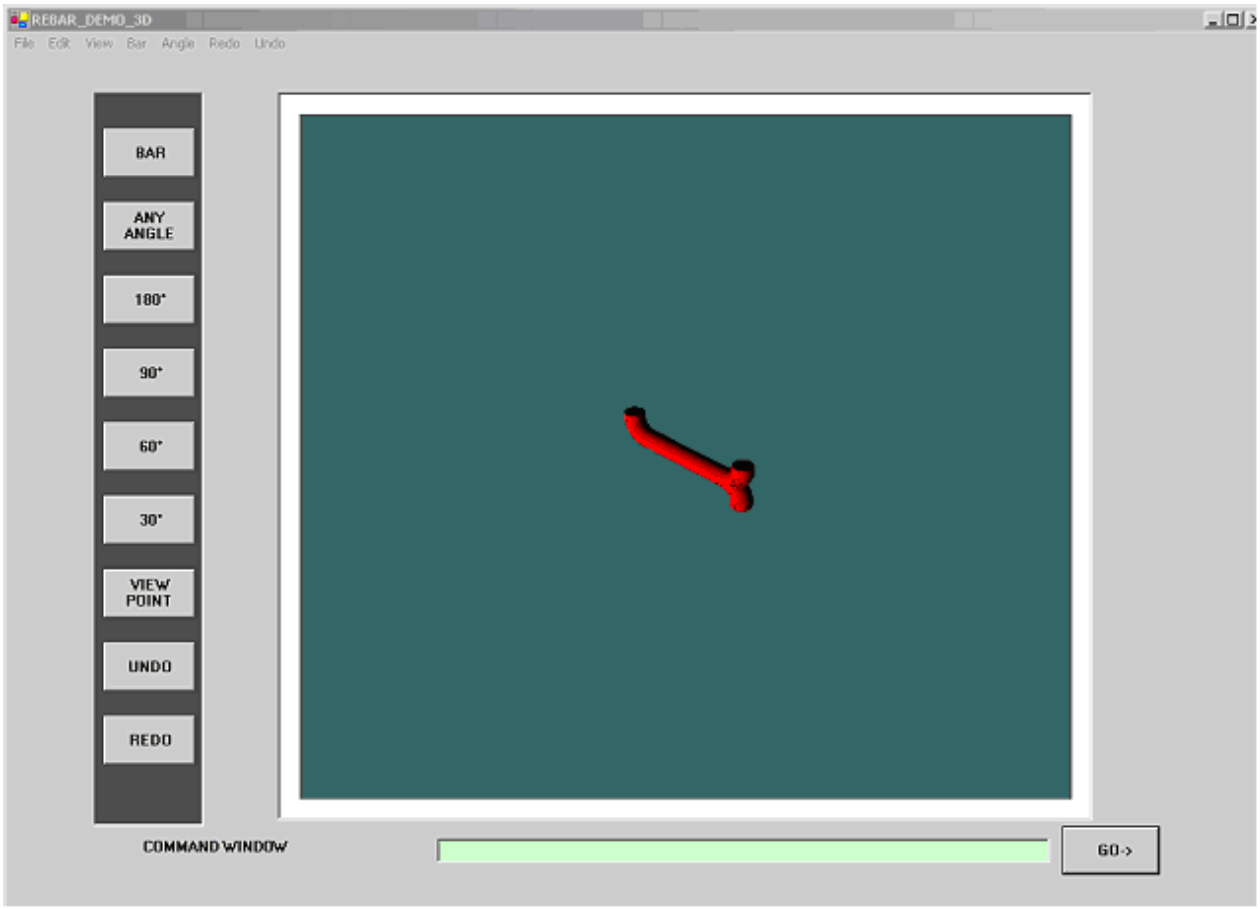
User can draw any number of bends attached with a bar. Following figure shows one more bend attached to the same bar.



To draw the above figure user needs to give the value of CHOICE as 1 since the arc is being drawn in the right side of the bar, LOCATION as 2 since the arc is in the upside of the bar and the BAR index as 3 since the arc is attached to the third last object.

User can view it from different viewpoints. Currently it is (0,0,-5) but it can be shifted to any point by using the button VIEW POINT.

The above image from different viewpoints is shown below.
From (5,5,-5) the above image will look like the following figure.

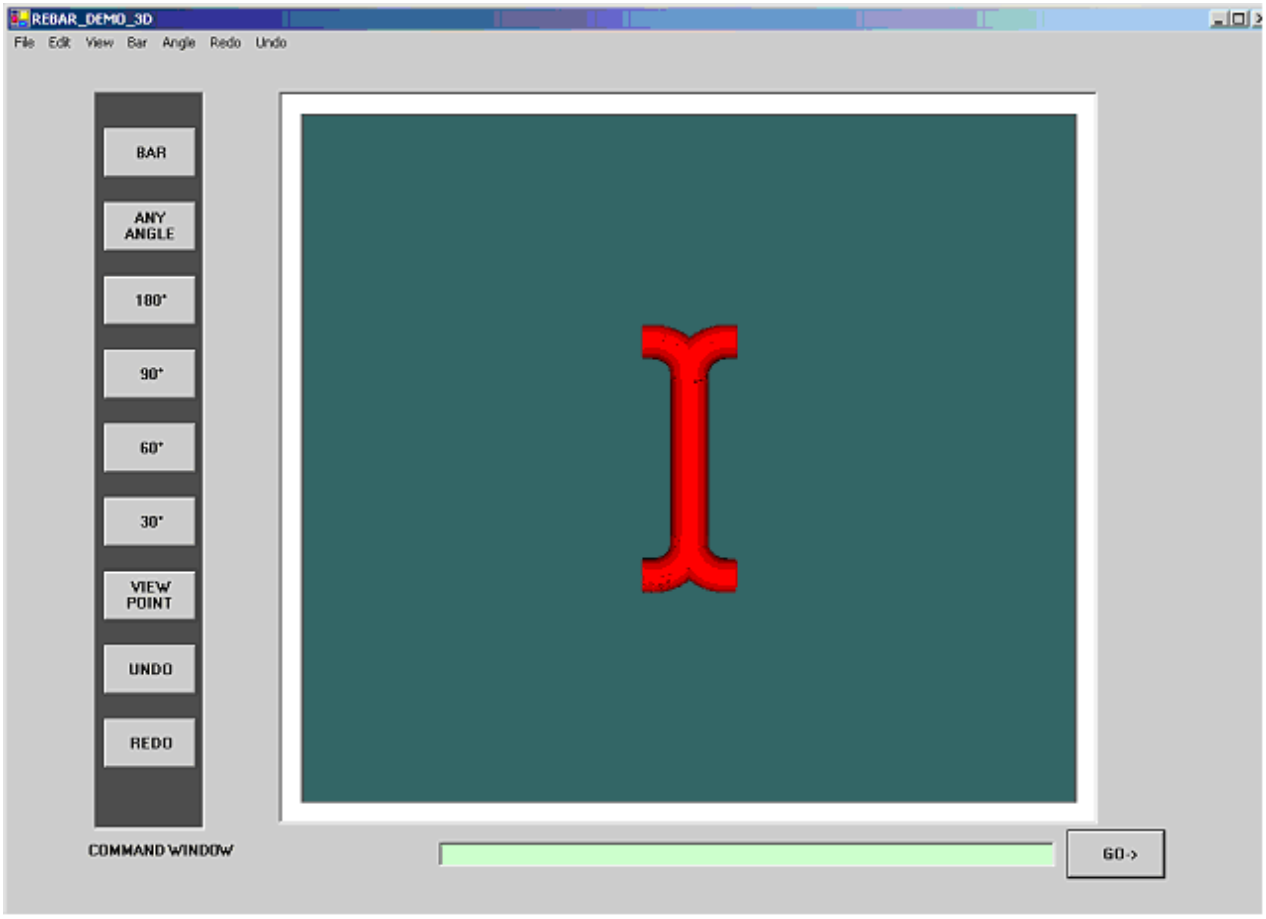


viewing the same image from different (5,5,-5)

Likewise user can view it from other viewpoints also.

EXAMPLE 5

User can draw the same kind of geometries in different planes also.
If user wants to draw a vertical bar, he needs to give ANGLE theta and ANGLE phi both as 90 as it is mentioned earlier in this document. If user wants to draw a bend at any end of the bar, same procedure has to be followed like it was done for the horizontal bar.



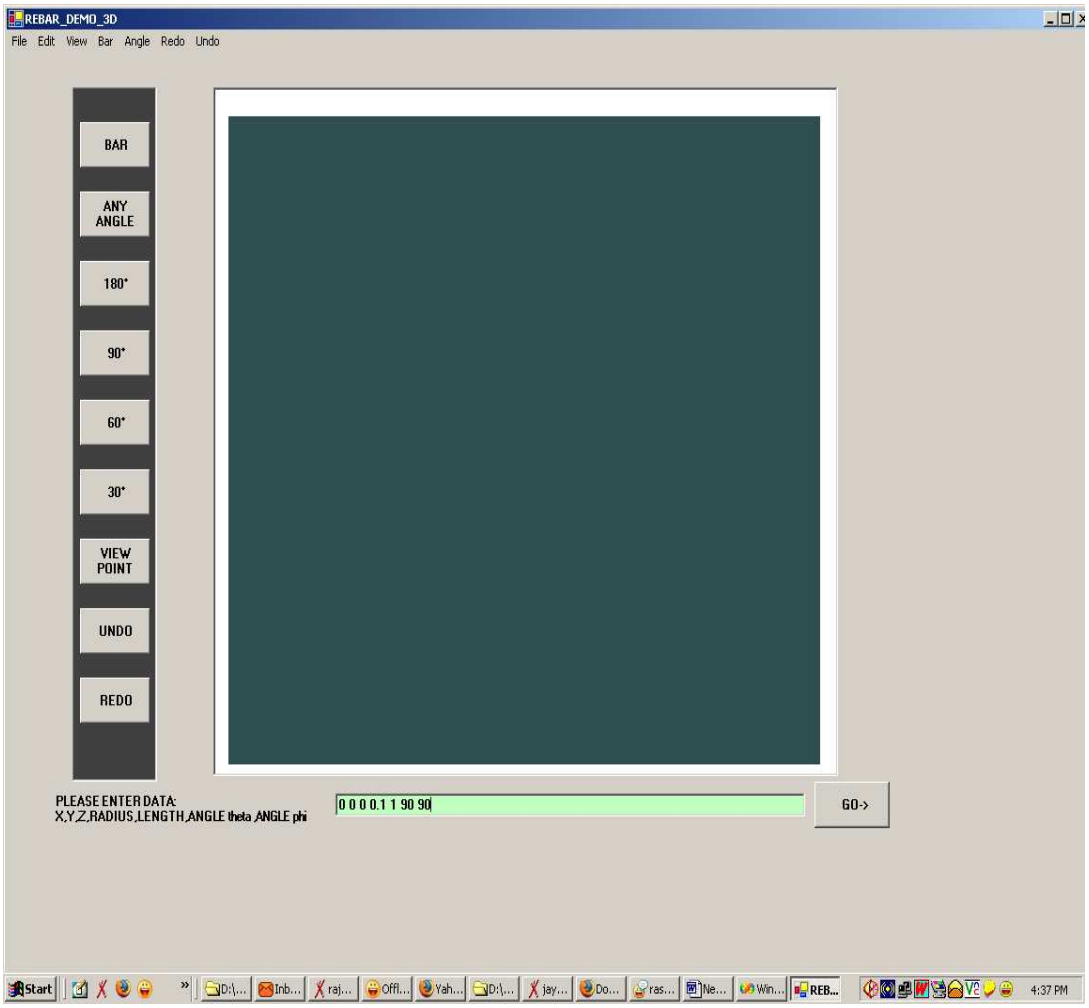
drawing bends at the ends of a vertical bar

Multiple Bars in Single plane

EXAMPLE 6

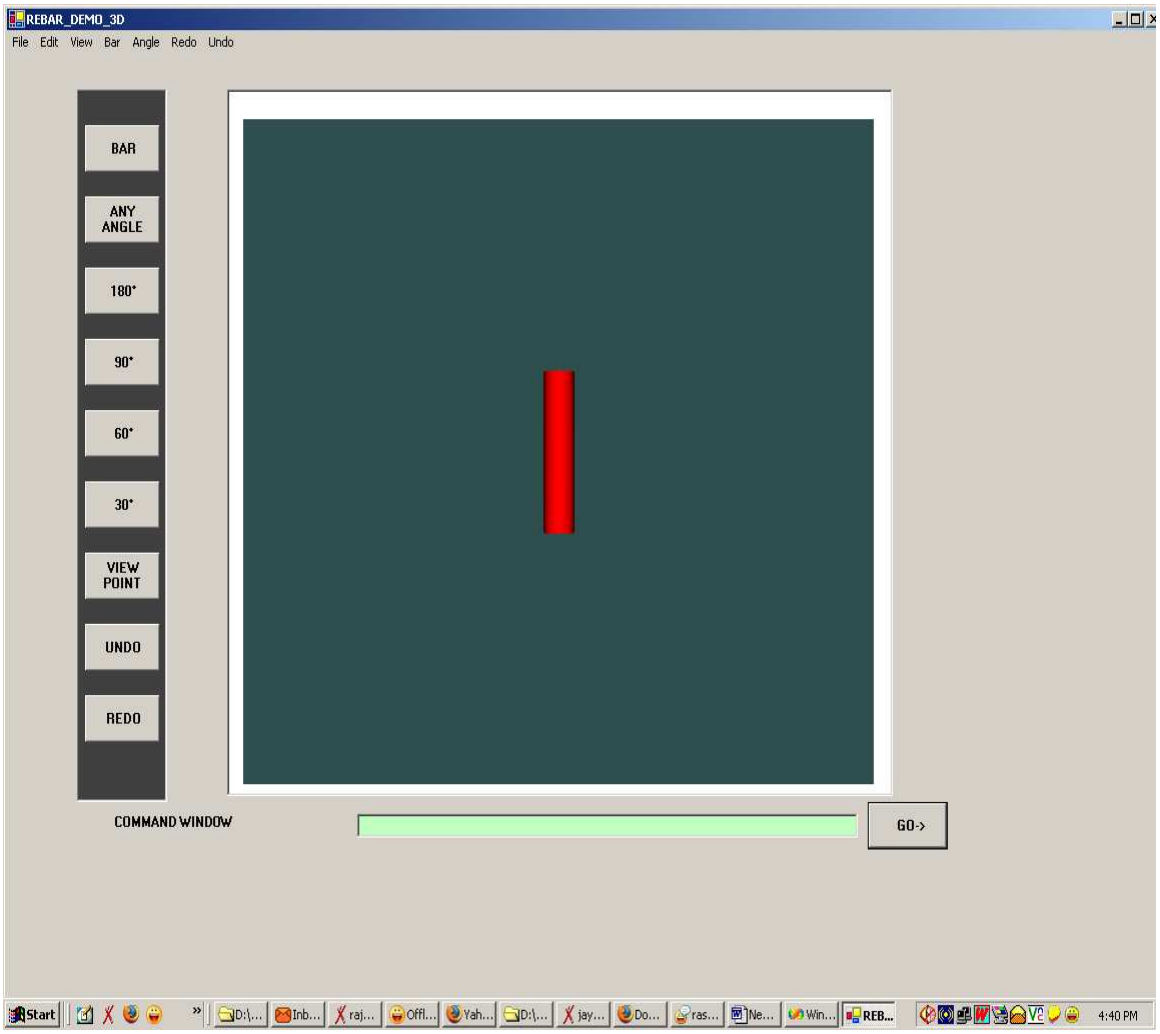
For drawing multiple bars, first the user needs to follow the same steps as needed for drawing the single bar i.e.

1) Click on the BAR button and enter the co-ordinates and other data on the Input Text Box as above. The window will be like this



entering all the values of parameters

2) Next Click on the GO button and you will see a vertical bar with its center at origin.

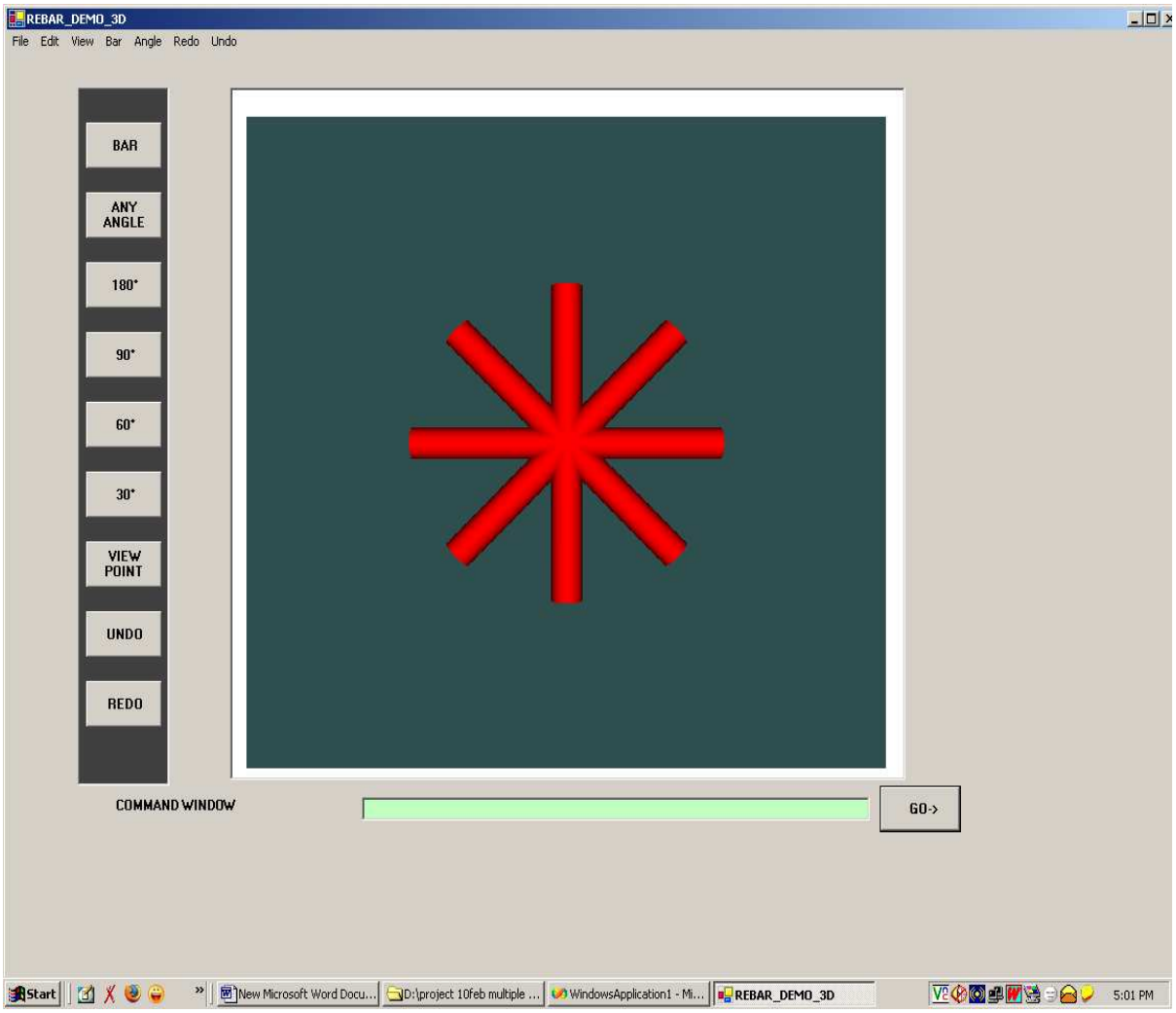


drawing the bar

Now, doing the same procedure you can make different bars at different angles in the same XY plane, here the Z co-ordinate is 0 and thus we are in the X-Y plane only.

Here we will be drawing four bars in space at different angles with the X-axis, that is the angle theta and angle phi of the various bars will be different.
The different input combinations of the next figure are
1)0 0 0 0.1 2 90 0
2)0 0 0 0.1 2 90 90
3)0 0 0 0.1 2 90 45
4)0 0 0 0.1 2 90 135

So,we see here that the ANGLE theta remains the same and only the ANGLE phi changes.



drawing different bars in one plane

Multiple bars in multiple planes:

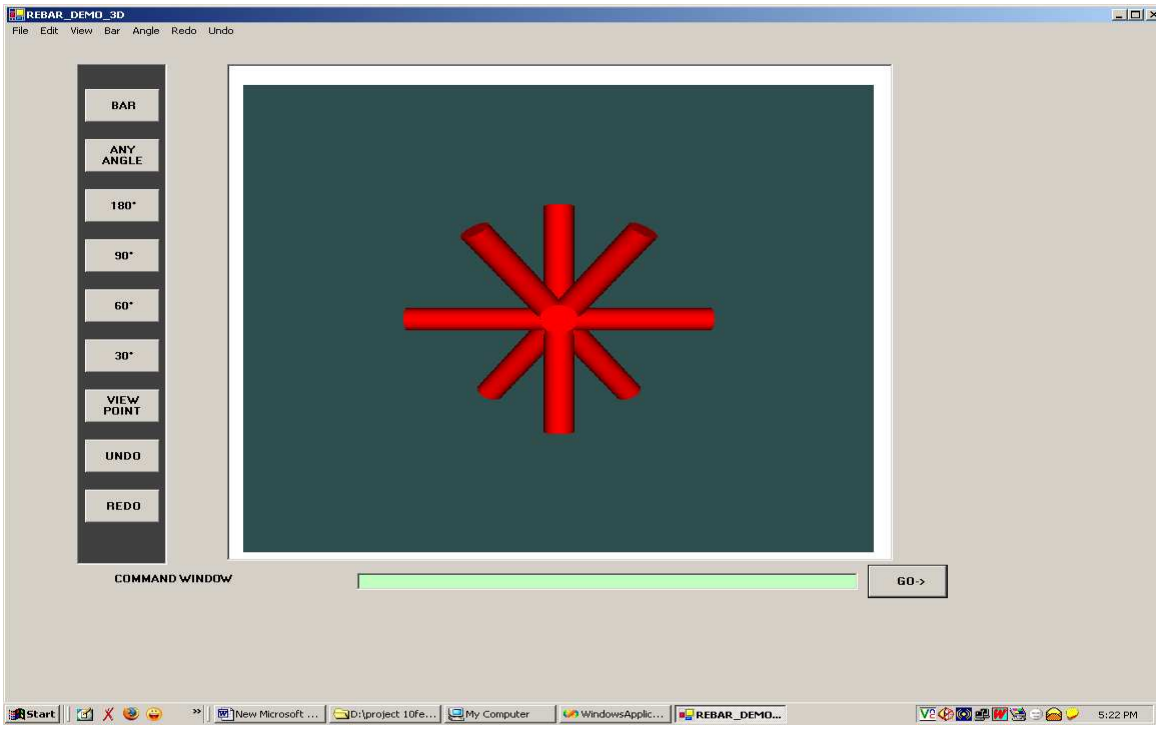
EXAMPLE 7

For achieving this we make all the bars as we did in previous cases but we change the parameters by a little.

Just give these as the input.
Click on button “BAR” and type in the command window. This is to be followed for all the bars

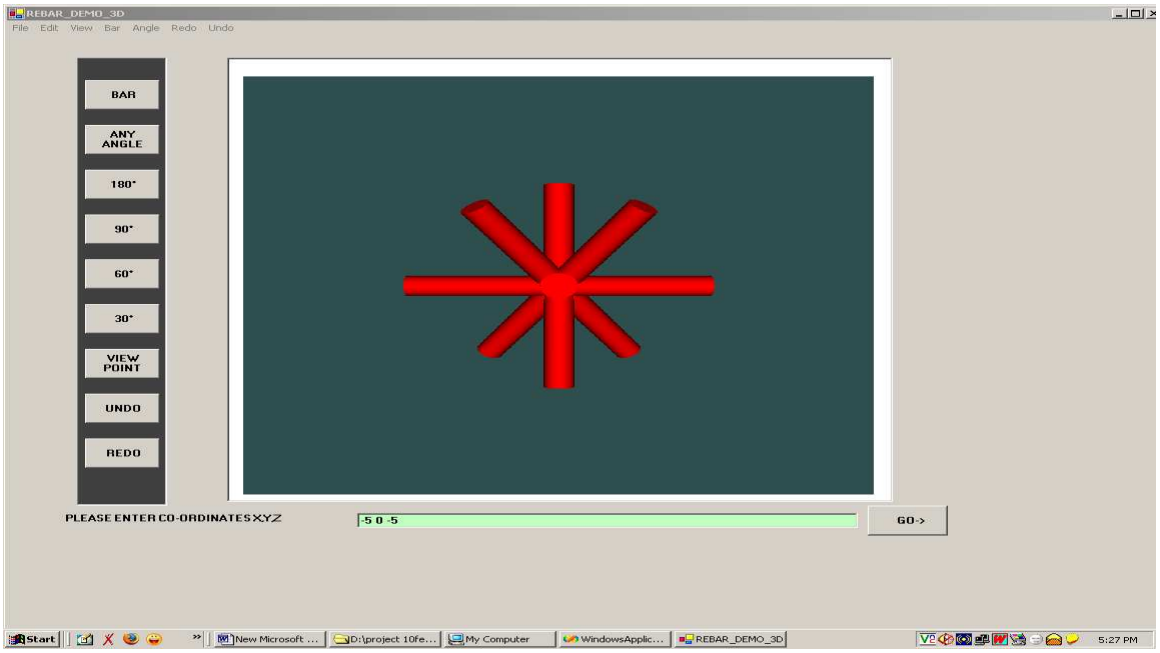
1)0 0 0 0.1 2 90 90
2)0 0 0 0.1 2 90 0
3)0 0 0 0.1 2 0 0
4)0 0 0 0.1 2 45 45
5)0 0 0 0.1 2 135 135

After the user has done that, the user will have the following figure



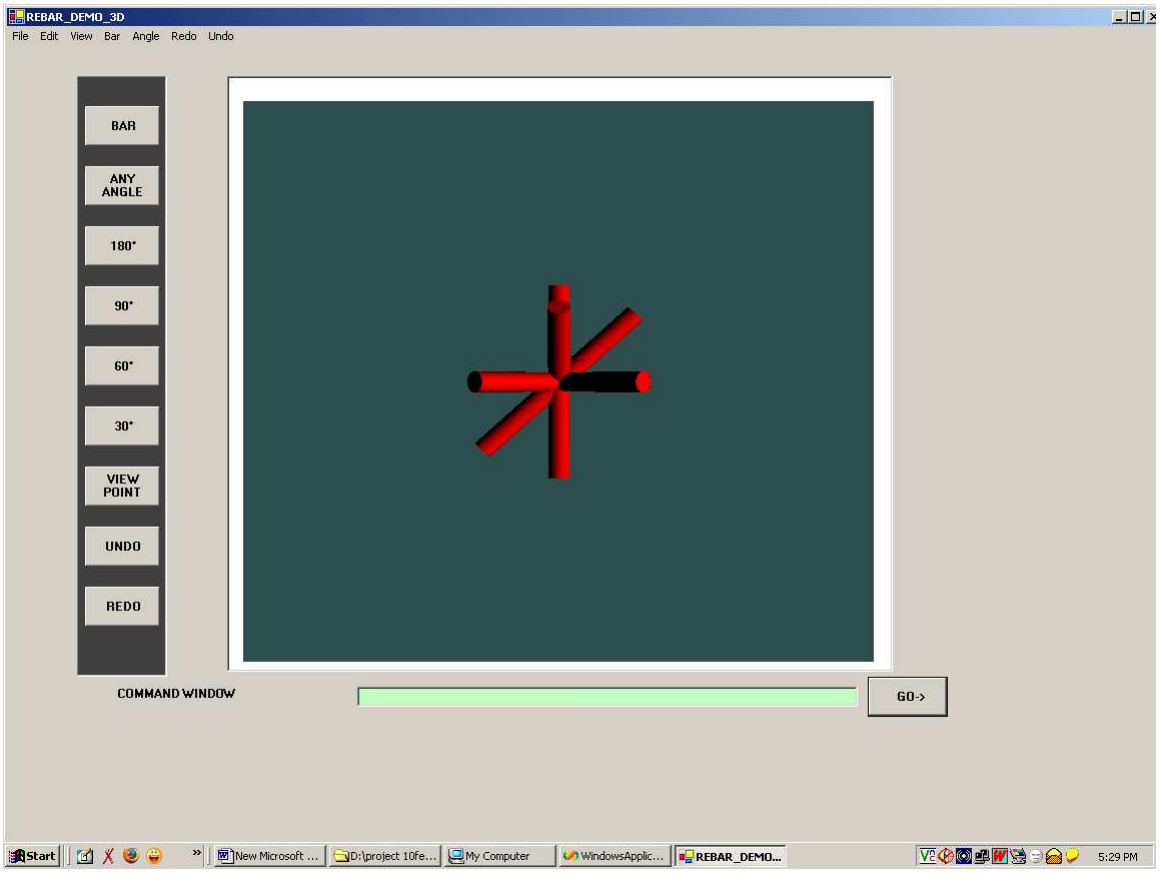
showing different bars in different planes

The above figure is in all the three planes, which can be seen by changing the viewpoint, for example



setting the viewpoint at (-5,0,-5)

In the above figure we set the viewpoint at –5 0 –5 i.e. in the negative X direction and negative Z direction and we can see the following figure.

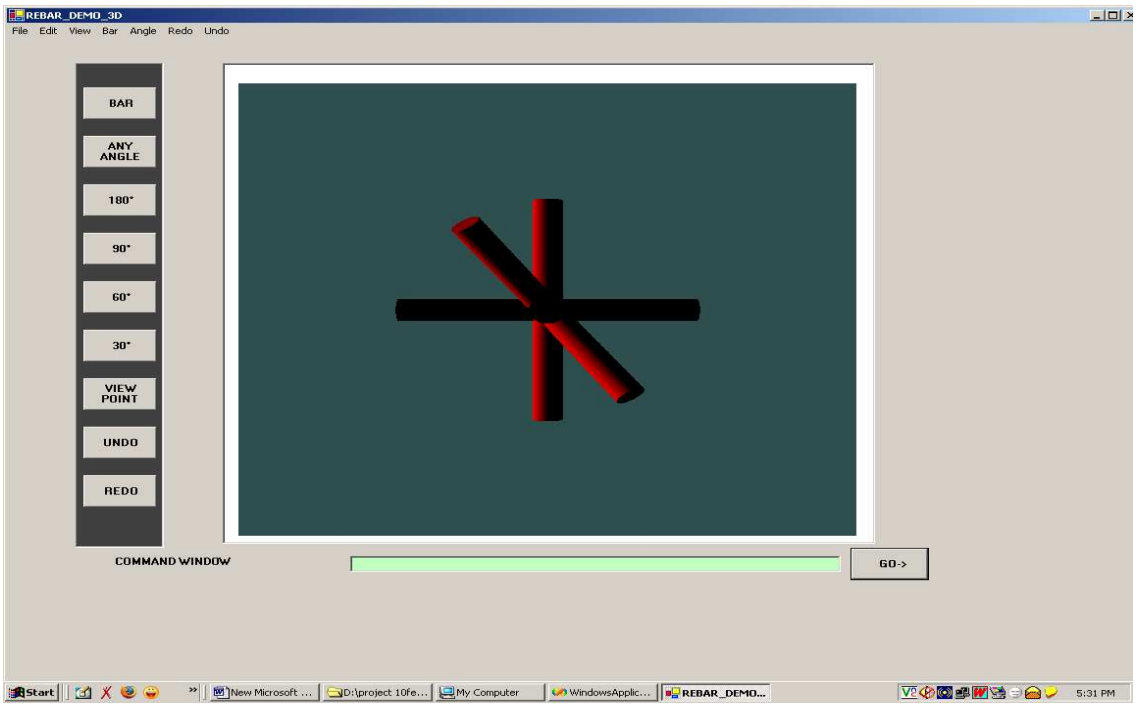


looking at the same figure from different viewpoint(-5,0,-5)

Now in the next figure we will be locating our camera at (5 0 0), that is we are moving in the X-axis and at a distance if 5 units from the origin.

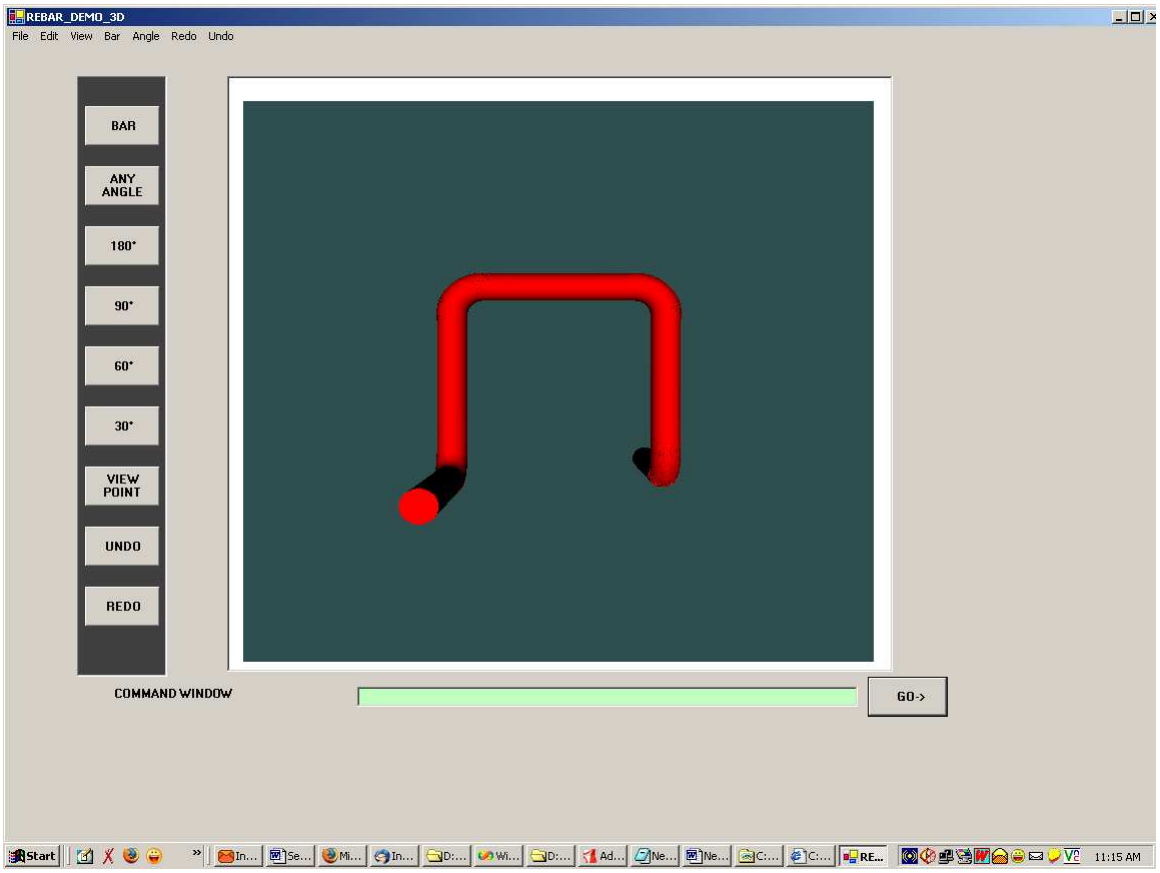
If we notice than we will see that light is illuminating from one side and other sides remain in the dark, we can understand this better if we imagine that light is coming from the front of the object and we are viewing the object at a distance of 5 units to the right of the object.

Hence we see some parts darker and some brighter, we can say that the 3D tool is giving us the same image, as we will perceive in the actual scenario.



viewing it from (5,0,0)

A Regular Shape: -

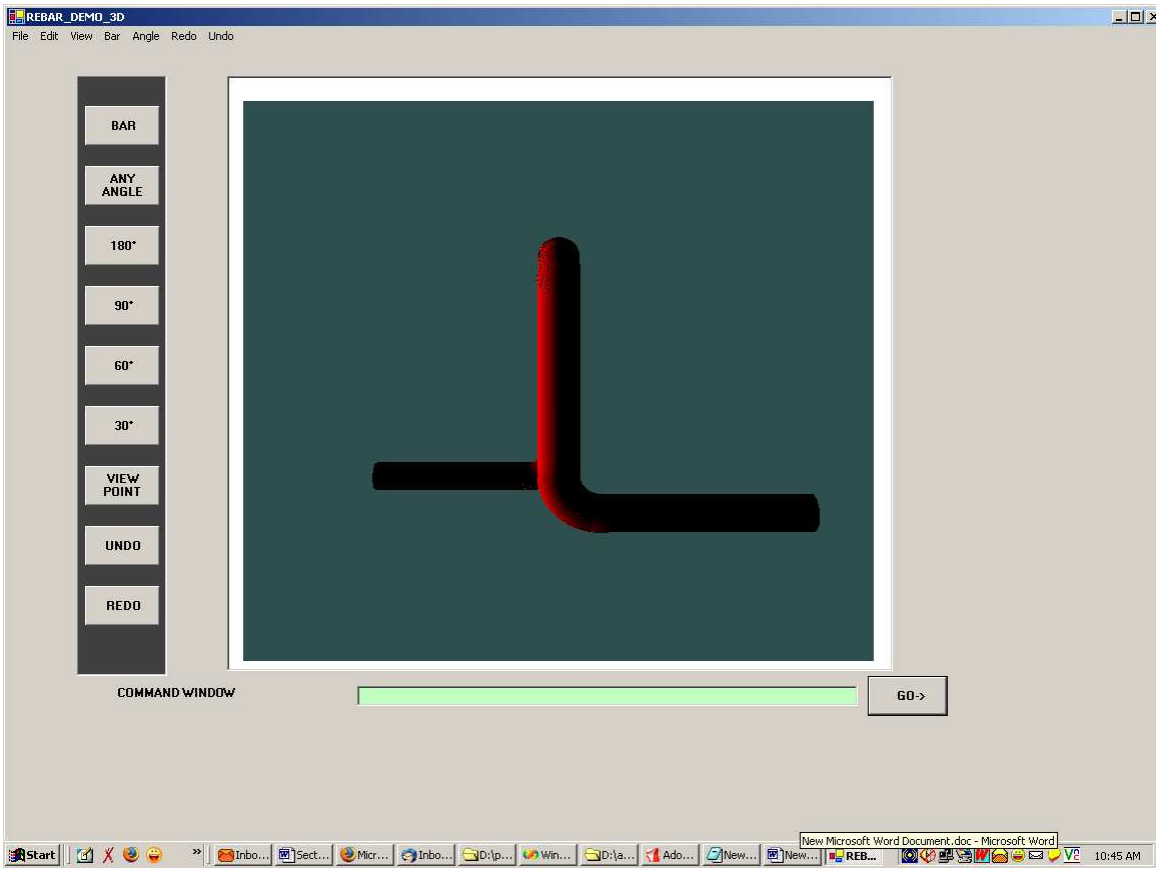


a random shape drawn by this tool

The above shape you see is a combination of bends and bars to make a useful shape, for drawing the above shape one has to input the following commands and specifications.

1) bar : - (-0.7 0 0 0.1 1 90 90)
2) arc : - (0.1 0.2 2 90 0 3 1)
3) bar : - (-0.7 –0.7 –0.7 0.1 1 0 0)
4) arc : - (0.1 0.2 1 90 0 2 3)
5) bar : - (0 0.7 0 0.1 1 90 0)
6) arc : - (0.1 0.2 1 90 0 11)
7) bar : -(0.7 0 0 0.1 1 90 90)
8) arc : -(0.1 0.2 2 90 0 4 1)
9) bar : -(0.7 –0.7 0.7 0.1 1 0 0)

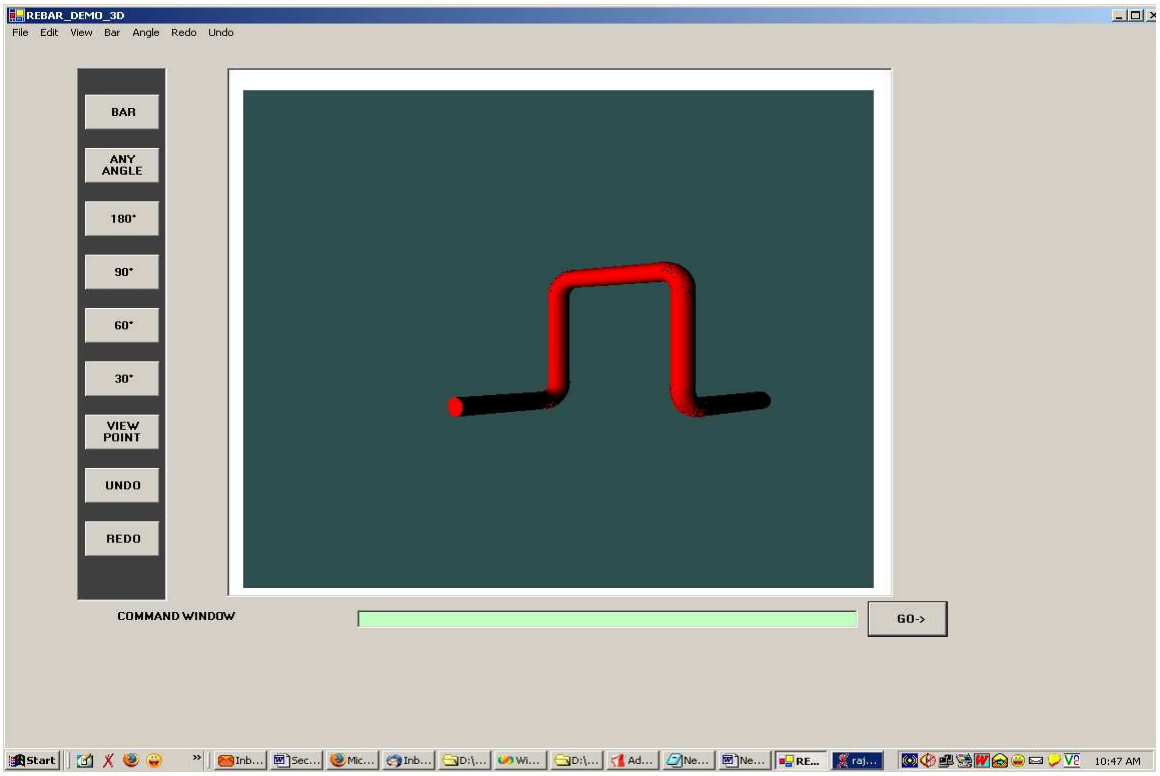
Now if you change the viewpoint to (5 0 0) ,you will have a figure like this,here you see that some parts are being illuminated while some are still in the dark, because of the positioning of the light source.



viewing the same image from different viewpoint (5,0,0)

The next figure will be showing the same image from a different viewpoint i.e. (5 0 –5)

So we can now visualize the object more clearly in space.



viewing it from (5,0,-5)

Another Regular Shape :-

Here we use several arcs and several bars for making the sample figure given down, one can make this shape by giving the following commands and following co-ordinates.

1)set the view point to (0 0 –15)
2)bar :- (0 0 0 0.1 1 90 90)
3)bar :- (0.7 0.7 0 0.1 1 90 0)
4)arc :- (0.1 0.2 1 90 0 1 1)
5)bar :- (1.4 0 0 0.1 1 90 90)
6)arc :- (0.1 0.2 2 90 0 2 1)
7)bar :- (2.1 –0.7 0 0.1 1 90 0)
8)arc :- (0.1 0.2 1 90 0 2 1)
9)bar :- (2.8 0 0 0.1 1 90 90)
10)arc :- (0.1 0.2 1 90 0 2 1)
11)bar :- (3.6 0.7 0 0.1 1 90 0)
12)arc :- (0.1 0.2 1 90 0 1 1)
13)bar :- (4.2 0 0 0.1 1 90 90)

after completing the shape ,it will come out to be like shown in the next figure, after this one may change the viewpoint and see the figure in different locations in space.

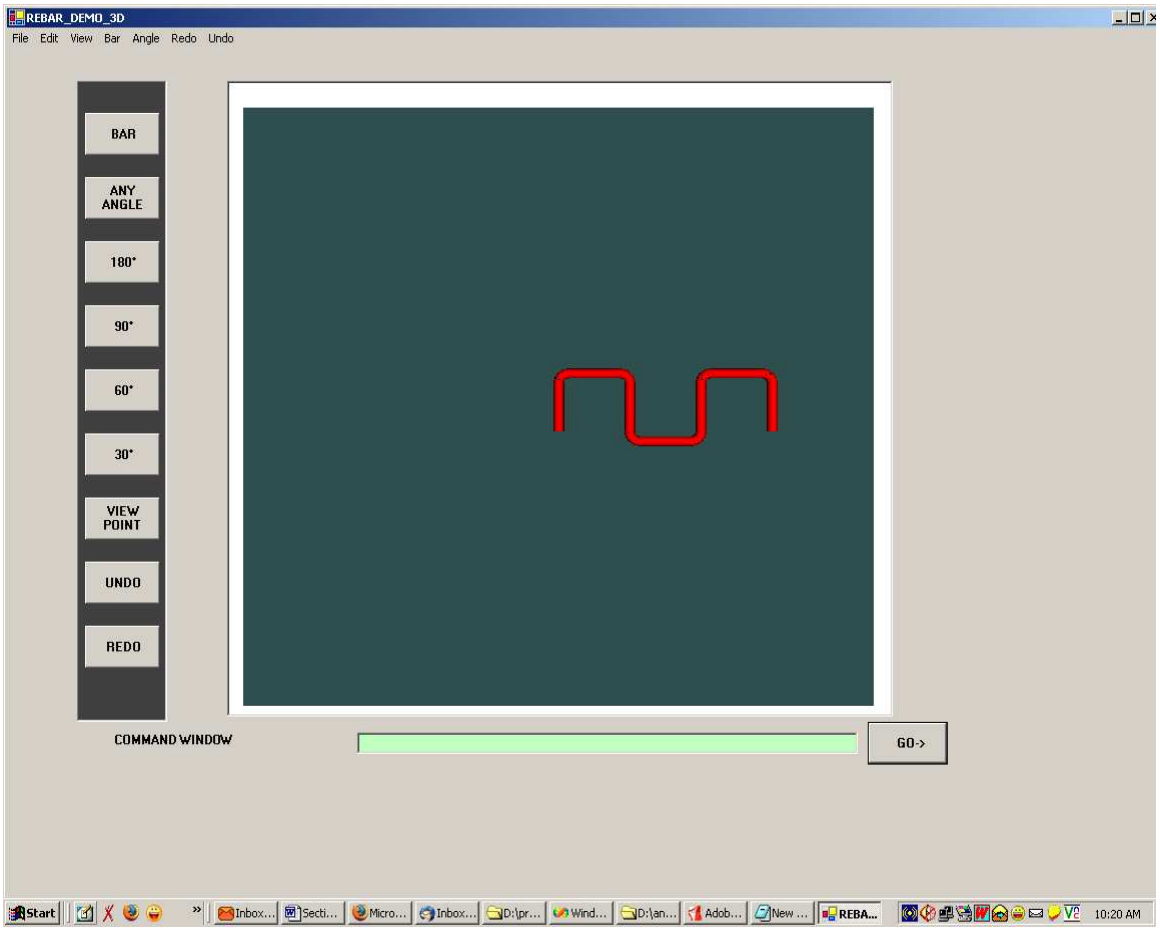


Fig. 27 another shape that can be drawn by this tool