AMass Tutorial

Introduction to the 2.20 Java AMass applet

The purpose of this document is to familiarize you with the 2.20 Java AMass applet. This applet can be found at http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-20Spring-2005/Tools/index.htm. It has been constructed for the usage of 2.20 students and can be used to approximate the added mass of various objects composed by spheres and cylinders. It will be used as a tool to solve homework problems.

The current Java applet can be used on any PC that has JAVA 3D installed. However, it should be *emphasized* that it is still under construction.

What follows is a short tutorial that will guide you through the basics of the AMass. The end result will produce four figures.

1. To install JAVA 3D: http://java.sun.com/products/java-media/3D/download.html. Click on the "Java" icon and follow the instructions.
2. To launch the applet go to: http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-20Spring-2005/Tools/index.htm and click on the AMASS icon.
3. On the "MAIN MENU" choose "Build Structure".
4. You will see a screen as in Figure 1. Choose "Build Structure", again.

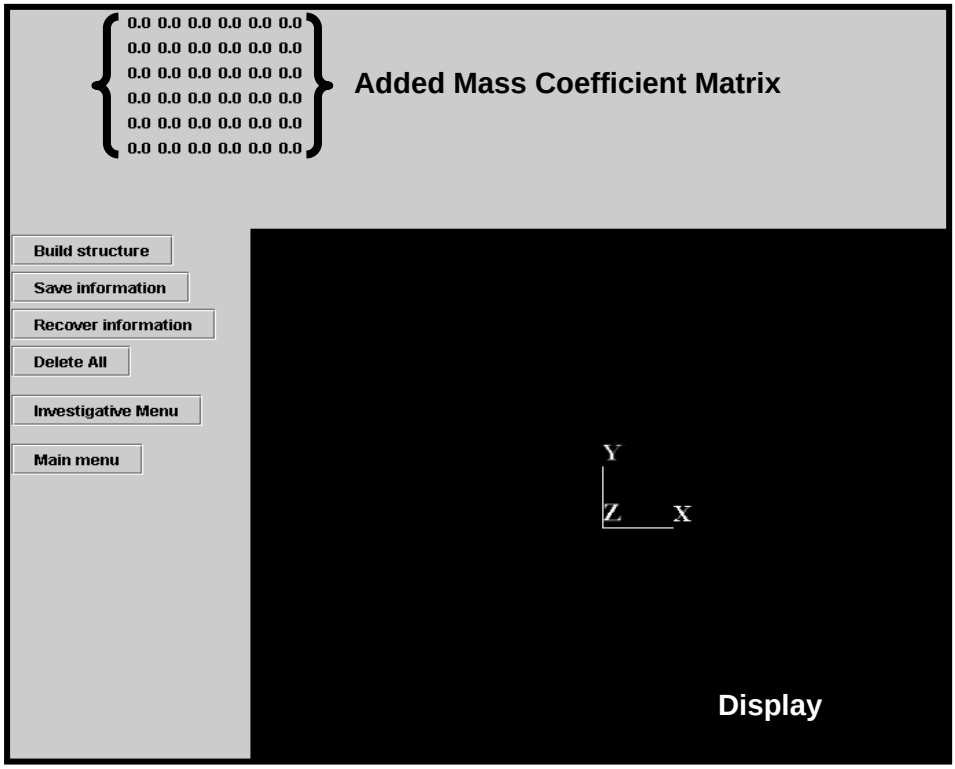

Figure 1

5. Choose “Add sphere”. In “Input radius” set the radius of the sphere to be 1. In “Input X/ Y/ Z displacement” define the coordinates of the center of the sphere at (1,2,3). Press “Enter”. You may choose to “Zoom out” to obtain a general view. By moving the cursor on the display area you obtain views of the object at various angles. Observe that the “Added Mass Coefficient Matrix” changes.
6. Choose “Add cylinder”. In the box “Input top radius” set the radius of the top to be 1. In “Input X/ Y/ Z top center” place the coordinates of the top center at (0,0,0). Repeat for the (bottom) base, with base radius 2 and coordinates of the base center at (1,2,3). See Figure 2.

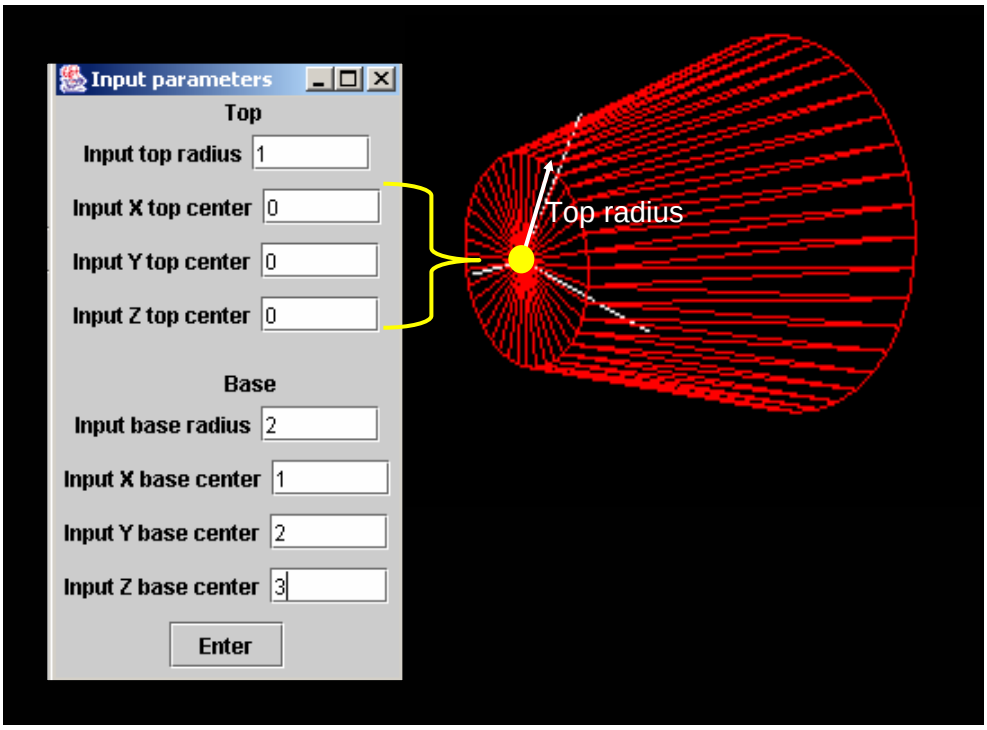

Figure 2

7. Choose “Delete”. Highlight both objects holding the “Shift” key, and press “Delete”. Everything will now be erased.
8. Choose “Add cone”. Now input the coordinate of the top (0,0,0), the coordinates of the base (1,1,1) and finally the base radius (2). Press “Enter”. You can “Zoom out” to have a more general view of the object.
9. Choose “Add elliptic cylinder”. In the first three boxes enter the coordinates of the bottom center (0,0,0). In the next three boxes enter only TWO of the coordinates of the end point of the 1st axis (x,z) = (-1,0). In “Input top second axis length” choose 0.5. For “Base” in “Input the X/ Y/ Z base center” set the coordinates of the base center (0,5,0). In “Input base first axis length” set the length of the 1st axis to 1. In “Input base second axis length” set the length of the 2nd axis to 0.5. See Figure 3.

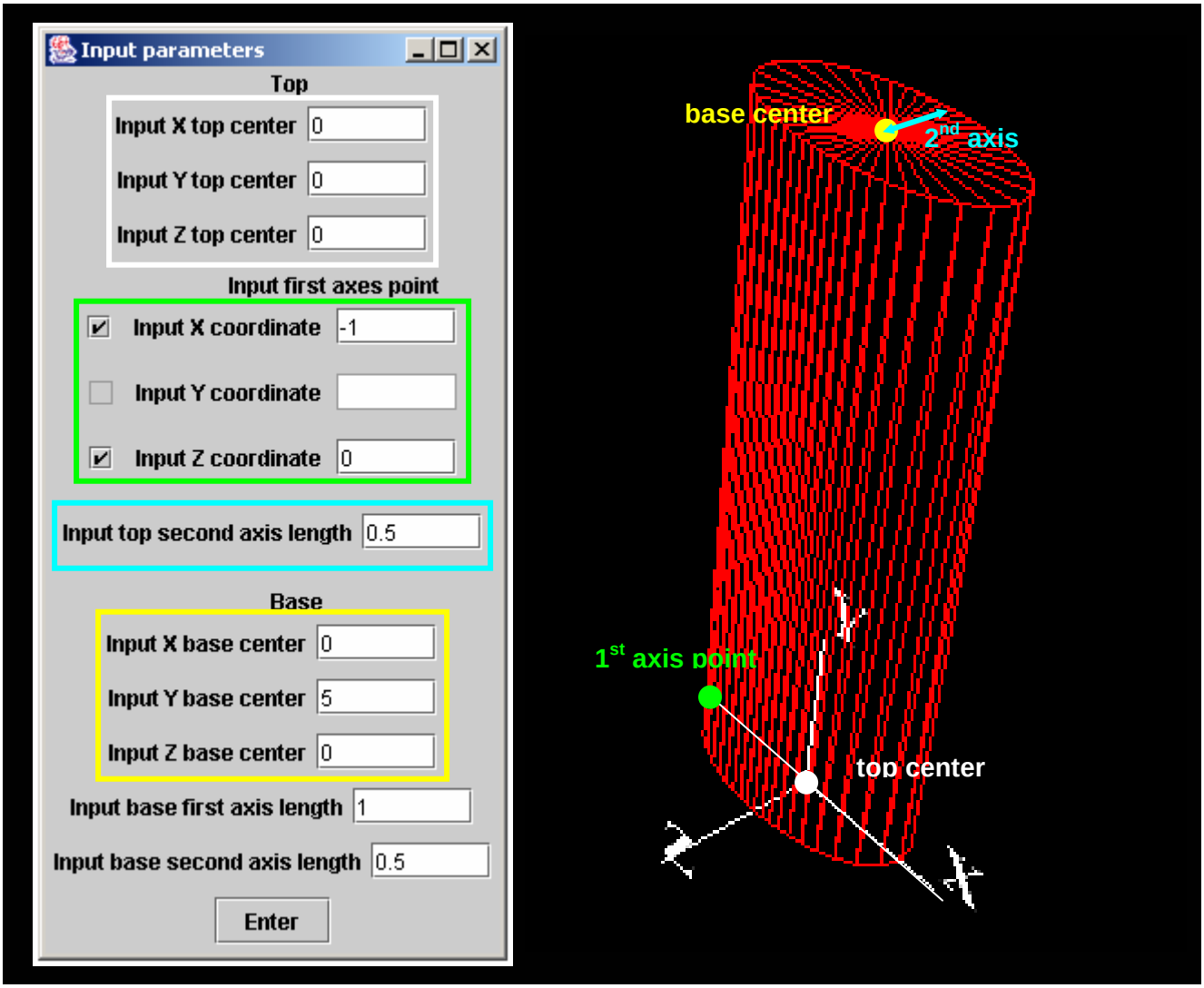

Figure 3

10. Click on “Delete”, highlight the “cone” option and press “Delete”. In the display area you will now see only the elliptic cylinder.
11. Choose “Working menu” and then “Investigate Menu”. In the investigate menu choose “Change motion” and specify velocities (6 d.o.f.) and accelerations (6 d.o.f.). Choose unit acceleration in 1 i.e. set velocity equal to (0,0,0,0,0,0) and acceleration to (1,0,0,0,0,0) respectively. Press “Enter”. Click on “Find force” and “Find moment” to find the forces and moments exerted on the body from the fluid. See Figure 4.

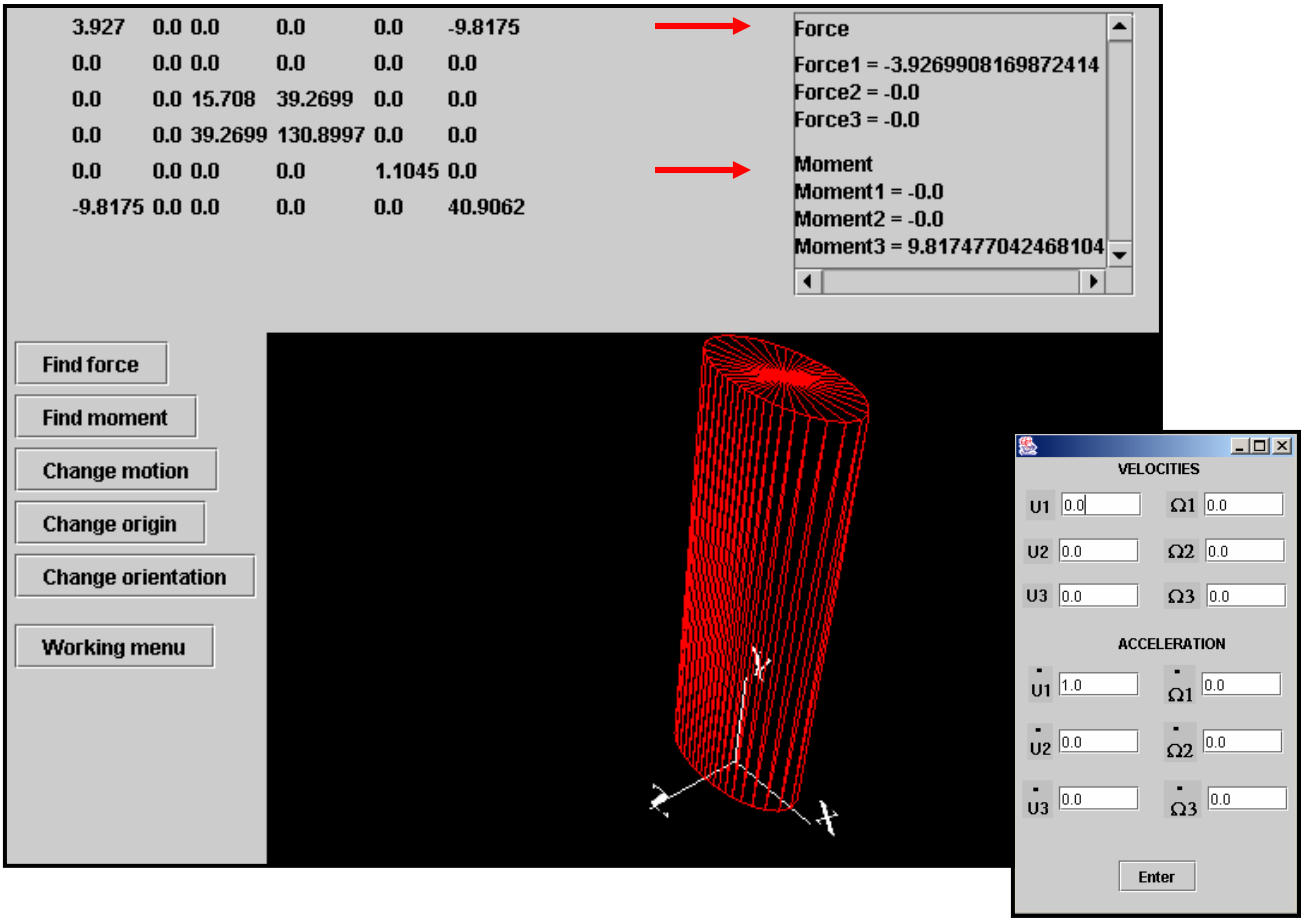

Figure 4

12. Enter various velocities and accelerations and observe how the forcing on the cylinder changes. In the example of the cylinder note that it is the m_{22} coefficient that is approximated by zero. You can also change the origin of the coordinate system (i.e. displace the cylinder wrt the origin) and observe how the added mass coefficient matrix changes.
13. Choose “Working menu” → “Build structure” → “Delete”. Add a sphere of radius 1 at (0,0,0) and verify the added mass coefficients we found in the example given in “Recitation 7”. Go to “Working menu” → “Change motion”, add an acceleration (1,1,1,0,0,0) and observe the forces. Click on “Change origin” and place the center of the sphere at (10,0,0). Verify the added mass coefficients evaluated in the example given at Recitation 7. Find the forces and moments for this case.

14. At this stage you might wish to save the information. Go to the “Main menu” and click on “Save information”. Save the file with a .txt extension. Click “Delete all”. You can re-open your work be choosing “Recover information”.