# Instructions for Matlab Elastic Simulation Program.

This Matlab program allows you to draw any 2D shape (in an ordinary paint program) and then interactively apply forces and watch that shape elastically deform in Matlab. To run this program, first download the zip file and then uncompress it on your computer. Next, run Matlab and the set the current directory to the folder where you uncompressed "elastic.zip". Finally, type "go" on the Matlab prompt and the program will begin using a default ring shape that I drew. Once you draw your own shape, you will type: go('myshape.bmp'). Note: Don't forget to put apostrophes around your image's file name.

To interact with the simulation, just slide the horizontal and vertical sliders. If you highlight the number in the text field in the bottom left you can set how strong a force you want the corresponding slider to exert. The best way to move the sliders is to use the keyboard arrow keys (before the keys will work, you must click the slider you wish to move with the mouse). Moving the horizontal slide right applies a right force to force spot #1 and a left force to force spot #2. Moving the vertical slide down applies a down force to force spot #1 and an up force to force spot #2. Click "incx" or "incy" to increase the background space of Matlab's display.

Below is an example. First I draw a rectangle in Photo Paint. I fixed the top left and bottom left side with a fixed boundary (procedure for this is explained below). I indicated a place on the right side for Matlab to apply force #1. I saved my gray scale image as 'box.bmp' inside the folder labeled images. From inside Matlab, I ran go('images/box.bmp'). After hitting "IncX" twice, and then changing the horizontal force from 3 to 50, and then moving the horizontal slider four spots to the right, I saw the window pictured below.
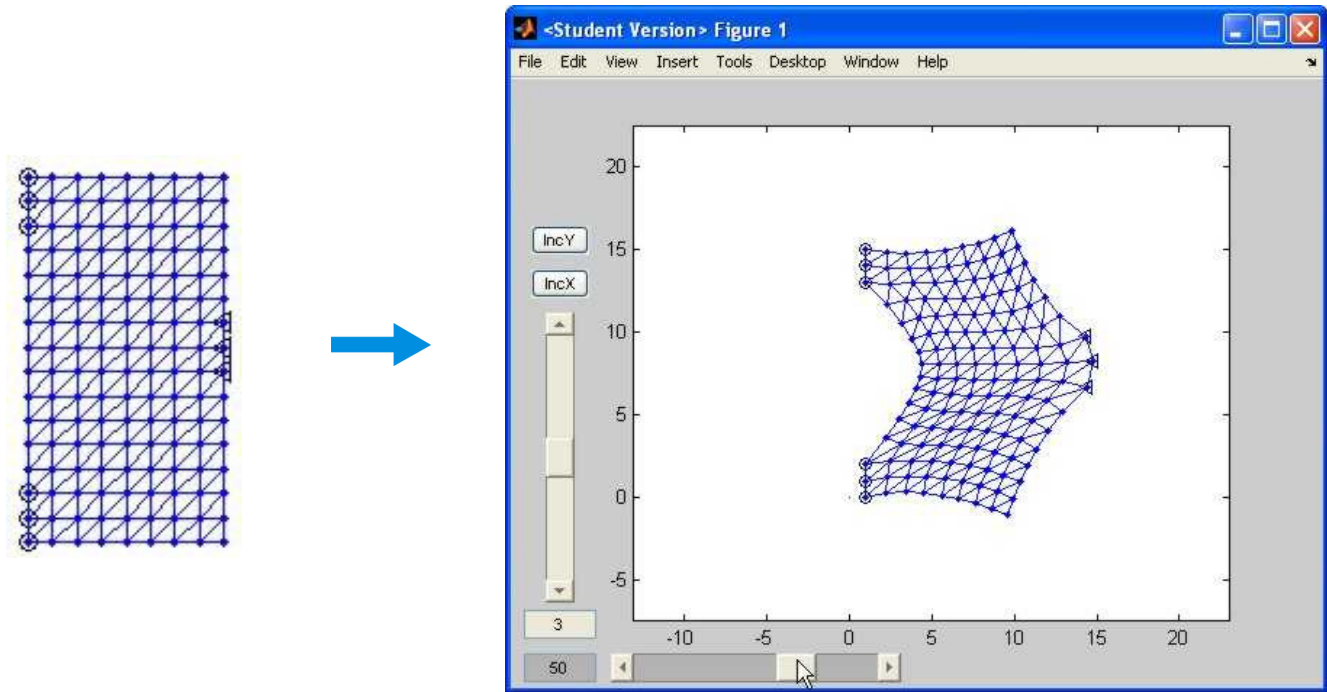
The last thing to learn is how to create your own shape, like a bridge or whatever you would like to simulate. This is done by using any standard paint program. Using the paint program, you will just draw a grayscale image. The general idea is to start with a white background and whatever you make black becomes your region. Lastly, you must define where you will apply forces and what part of the boundary is fixed. Here's how

Make sure you create a grayscale, 256 color, 8-bit or 24-bit image, and save it in a format that Matlab recognizes, which includes, gif, bmp, tif, jpg, etc. When designing your image, use the following facts. First of all your simulation will run much faster if you don't use two many pixels. The rectangle above was created from an image that was 10 by 20 pixels. This is important don't try to use an image with hundreds or thousands of pixels!!

When drawing your images, here are the rules: A black (color=0 or RGB=(0,0,0)) pixel becomes part of your region. When a black pixel has a while (color=255 or RGB=(255,255,255)) pixel neighbor, Matlab knows that is the boundary of your region. A slightly off white (255>color ≥ 225) neighbor pixel creates a fixed boundary. A moderate off white (225>color ≥ 200) neighbor tells Matlab where to apply force #1. While a strong offwhite (200>color ≥ 175) neighbor is where Matlab will apply force #2. Here are two examples. Numbers on the blocks refer to that pixel's color where color=x is RGB=(x,x,x)
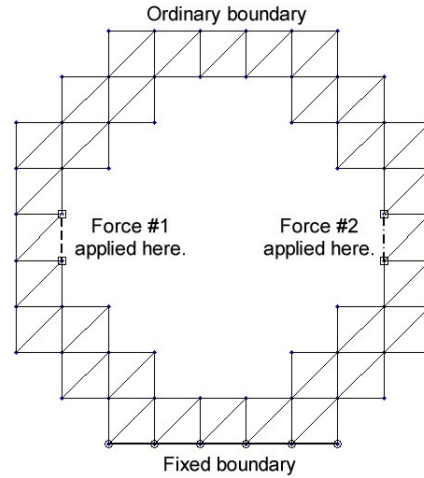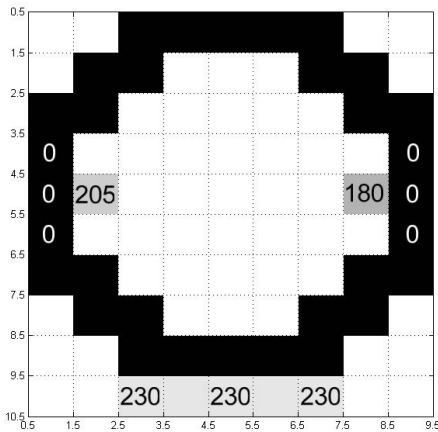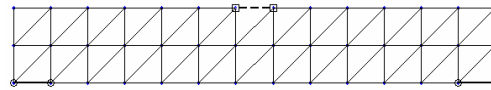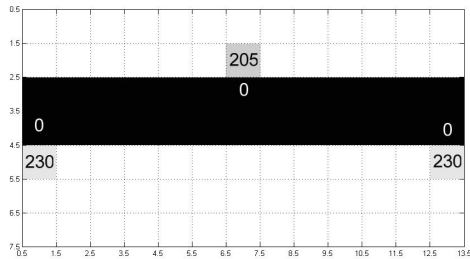
There is one special feature. If an off white pixel touches more than one black interior pixel but you wish to limit the boundaries to be identified, you can indicate the boundaries you want by using off black (10<color<100) for the interior pixels.