Soap Bubble Wires: The Energy of Bubble Films

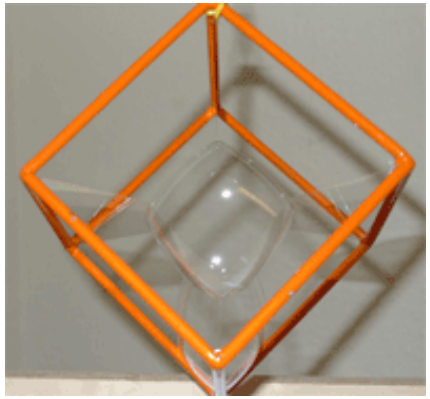
The soap bubbles we normally see are beautiful and of all sizes, but only one shape: they are all spherical. The reason is that this is the shape that contains the pressurised air within, with the least surface area, a fact which can be shown mathematically. This is the result of the molecules within the soap film acting to find the shape which will minimise the energy stored in the film.

So what happens if we try to control the shape of the film by using a wire frame? This activity lets students experiment with various shapes of film to see how nature solves the problem in each case:

Each different wire frame can be lowered into the soap solution. When carefully withdrawn, a soap film can be seen formed by the wire frame.

The shape of the film is different for each frame and students can discuss why this might be and whether other solutions are possible. It is also worth looking at the lines which join the soap planes; are they always straight?

Further insights can be gained by ‘capturing’ soap bubbles which have formed on the surface. These are pulled into the frame and, by following the ‘least energy’ principle, new and more complex shapes can be formed:



In the case of the wire frames the soap bubbles form a surface which has the wire as its boundary, but also has the minimum surface area. This particular surface is then called a minimal surface.

Minimal surfaces are important to mathematicians, but also to engineers and designers. For example, designers sometimes want structures where stress is distributed as evenly as possible, so they choose minimal surfaces.