DEVELOPMENT OF LARGE SCALE EDUCATIONAL ATOMIC FORCE MICROSCOPY

Nick Iacopino (Keunhan Park, PhD)
Department of Mechanical Engineering

The advancement of nanotechnology is extremely important in today's world. As electronics get smaller and faster, exploration on the nanoscale becomes increasingly important.

Atomic force microscopy (AFM) is on the cutting edge of this exploration as it has the ability to measure surface characteristics at sub-nanometer resolution. To put that into perspective, the thickness of a human hair is around 90,000 nanometers wide. Even with the ever-growing demand of AFM, the fundamentals are rarely taught in the middle and high school levels as real AFMs are very expensive and too compact to see the mechanisms at work directly.

The aim of this research was to address this issue by developing kits for fully automated, large scale, and low cost AFM models that can be used in a classroom setting in order to educate young people on the basics of nanotechnology.

Atomic force microscopy (AFM) is a simple process in which a sharp tip, attached to a cantilever, scans across the surface of a sample material. A laser beam reflects off the topside of the cantilever and into a photodetector, which measures the position of the reflected beam. As the cantilever moves up and down according to changes in the surface texture of the sample, the angle of the beam changes and a contour map of the surface can be plotted.

In order to visualize the working mechanics of Atomic Force Microscopy, the Lego® AFM was developed. This easy-to-build project uses Lego® bricks to simulate true microscopy on a much larger scale. The probe tip used in the Lego® AFM has about a 2 mm radius compared to true AFM tips which typically utilize a tip radius of around 10 nanometers(10^{-9}m). This magnification makes it much easier to see how Atomic Force Microscopy works. The advantage of this system is that it makes nanoscience fun and interesting for younger students. The intent is to motivate these students to further their education in STEM fields.