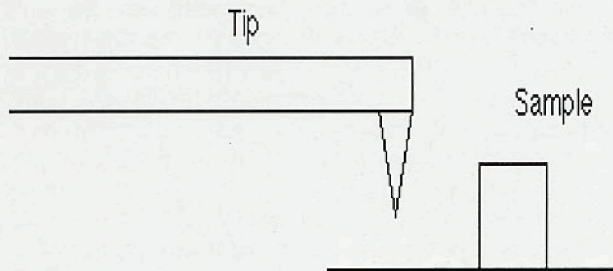


SPM Tip Convolution

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Why is it that tip convolution effects rotate with the scan angle in a Nanoscope-based AFM (and possibly other systems)? The tip certainly doesn't rotate in its holder as the scan angle is changed! I posed this question on the SPM mailing list, and got several answers in return, but I was still puzzled until I put all of them together and thought a while. However, I may not be the only puzzled soul out there, so let me attempt to summarize what I've come to understand:

A good way to think about this is to consider a right-triangle tip approaching a cube on a surface:



If the tip approaches the cube along the plane of the page screen, the left side of the cube will appear sharp in an AFM image and the right side of the cube will have a slant introduced into it due to a tip convolution effect.

Now if the scan angle is changed to 45 degrees, the tip will move over the cube at 45 degrees to its face, but it will still be in exactly the same orientation relative to the cube. So the same edge of the cube will be made non-square as before. Most imaging software will rotate the image shown on the CRT screen such that the raster axis is horizontal, so the cube will appear at 45 degrees on the screen, with the slanted face also rotating 45 degrees. Thus the tip convolution effect rotates with the scan angle.

However, as Dan Chernoff (Advanced Surface Microscopy, Inc.) pointed out last week, if the sample is physically rotated 45 degrees but the scan angle is unchanged, the cube will appear at 45 degrees, but now the slant on the tip will hit two of the faces rather than just one. The tip convolution effect will not rotate as the sample is rotated. Thus rotating the sample is a good diagnostic for tip convolution effects, whereas changing scan angle is not.

My apologies to those for whom this is obvious. It caught me unaware. I hope my confusion and explanation will make this a bit clearer for others similarly puzzled. ■



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