Feedback control for constant height mode operation in scanning near-field microwave microscopy

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Scanning Near-field Microwave Microscopy (SNMM) is one of the versatile tools to probe the surface of a materials for both electrical and magnetic properties. The near-field radiation emanating out of the electrically small mono-pole is the key for the spatial resolution. To evaluate the surface properties in a quantified manner, it is essential to understand the behaviour of the near-field of the mono-pole in the vicinity of the sample. At the same time to improve the spatial resolution of the imagery, it is essential to study the geometry of the mono-pole, distance between the mono-pole and sample and the impedance contrast between the adjacent regions. To obtain a stand-off distance close to nanometers and to compare the topography, commercial microwave microscopy instruments use atomic force microscopy (AFM) with a specialized microwave attachment. This enhances the cost of the equipment. Being a non-contact technique, achieving such a stand-off distance without a commercial AFM is a difficult task. A simple but efficient feedback control is developed to achieve a constant height mode operation. The feedback control, based on phase variation, is sensitive to the properties of the sample surface. This method paves way for reducing the cost of the instrumentation. The merits and demerits of the mechanism is explained in this presentation.