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# Optimal Design and Evaluation of Cantilever Probe for Multifrequency Atomic Force Microscopy

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## Abstract

In multifrequency atomic force microscopy (AFM) to simultaneously measure topography and material properties of specimens, it is highly desirable that the higher order resonance frequencies of the cantilever probe are assigned to be integer harmonics of the excitation frequency. In this paper, a structural optimization technique is employed to design cantilever probes so that the ratios between one or more higher order resonance frequencies and the fundamental natural frequency are ensured to be equal to specified integers. A one-layer probe with variable width is optimally designed for assigning single and multiple resonance frequencies. Moreover, a three-layer model is proposed to provide more frequency choices. All the designs are verified by experiments, through the focused ion beam (FIB) milling based fabrication technique and AFM measurement.

## References

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