title:

Fast estimation of nonlinearities in atomic force microscopy

abstruct:

We propose a fast method to reconstruct the curve of tip-surface force v.s. distance in Atomic Force Microscopy (AFM). A precise and fast force curve reconstruction can help improve research in material science, biological science, chemistry, etc. Existing techniques require multiple sinusoids at the input to introduce intermodulation terms, i.e., exponential components at equally spaced frequencies, and the estimation is done by balancing those terms. Instead of using intermodulation terms, our method tries to balance time domain samples. The method is based on the assumption that a discrete model approximates the continuous AFM model well when sampled at high frequency. Least Squares method is used to derive a polynomial approximating the force curve. The new method can make use of samples in the transient process and does not require multiple sinusoids at the input. It has potential benefits in taking less testing time, getting more accuracy and acquiring force curves of several materials in one experiment.