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Combining Amplitude and frequency Modulation in Atomic Force Microscopy DAVID HAVILAND, DANIEL FORCHHEIMER, DANIEL PLATZ, Nanostructure Physics, Royal Institute of Technology (KTH), ERIK TOLHÉN, Intermodulation Products AB — Dynamic AFM is usually sorted in to one of two general categories: Frequency Modulation (FM-AFM) or Amplitude Modulation (AM-AFM). These names refer to the way in which feedback is performed while scanning over the surface. In either category the tip-surface interaction is viewed as a *passive* modulation of the response to a single drive frequency, modulating either the amplitude or phase of the response. Often an extra feedback (phase locked loop) is used to measure the response phase as a shift of resonance frequency. An alternative approach to measurement is *active* modulation of the drive force on the cantilever, while monitoring how this active modulation is modified by the tip-surface interaction. Such active modulation can be frequency or amplitude modulation, or both. The method is realized by driving the cantilever with a frequency comb and measuring the response at all frequencies in the comb in a phase coherent way. In comparison with single drive methods the frequency comb method can acquire much more information in the same amount of time. We will demonstrate how this technique allows one to go beyond simple linear approximations, allowing for rapid and accurate reconstruction of the non-linear tip-surface interaction in AFM.

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