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Interaction imaging with amplitude-dependence force spectroscopy DANIEL PLATZ, DANIEL FORCHHEIMER, Royal Institute of Technology (KTH), Stockholm, Sweden, ERIK THOLÉN, Intermodulation Products AB, Solna, Sweden, DAVID HAVILAND, Royal Institute of Technology (KTH), Stockholm, Sweden — The ultimate goal in atomic force microscopy (AFM) is the combination of imaging with accurate force measurement. Dynamic AFM offers only qualitative information about the tip-surface interaction while imaging, because the sharp cantilever resonance efficiently filters out the high frequency components of the tip-surface. Traditional force measurements are based on slow, point-wise surface approaches and are incompatible with imaging. Here, we present a method called amplitude-dependence force spectroscopy (ADFS) that enables quantitative dynamic force reconstruction at every point of an AFM image, while scanning at normal speeds. ADFS breaks with the paradigm of constant tip oscillation amplitude, as the oscillation amplitude is rapidly modulated at every image point. The measured response gives the amplitude-dependence of the Fourier component of the force at the resonant frequency, which allows for a model-free reconstruction of the tip-surface. We have made rigorous tests of ADS using numerical simulations and have used it for a detailed study of the mechanical properties of polymer surfaces. The amplitude-dependence of the response in dynamic AFM provides a new and coherent framework for the description of conservative and dissipative tip-surface forces.

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