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Mapping the viscoelastic response of hydrogels at the nanometer scale. DAVID HAVILAND, PER-ANDERS THOREN, RICCARDO BORGANI, DANIEL FORCHHEIMER, DANIEL PLATZ, ILLIA DOBRYDEN, PER CLAESSON, Royal Institute of Technology (KTH) — We demonstrate a powerful new method for high-resolution mapping of the viscoelastic response of soft material surfaces at the nanometer scale. Dynamic Atomic Force Microscopy is performed with a special multi-frequency lockin amplifier that captures very high order intermodulation distortion of the cantilever motion, resulting from the nonlinear tip-surface interaction. Frequency domain analysis of this distortion reveals the conservative and dissipative forces between the tip and the surface, giving detailed information about the nonlinear interaction. We describe a new type of interaction model that treats the motion of the tip and surface as a dynamic two-body problem [1]. The model works extremely well with a wide variety of soft materials. Comparing simulations of this model to experimental data, we extract the viscous and elastic force coefficients on the surface of hydrogels, revealing heterogeneity at the nanometer scale. [1] D. B. Haviland et al. Soft Matter, DOI: 10.1039/c5sm02154e

David Haviland
Royal Inst of Tech

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