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High bandwidth linear viscoelastic properties of complex fluids from the measurement of their free surface fluctuations BASILE POTTIER, LAURENCE TALINI, CHRISTIAN FRÉTIGNY, PPMD-SIMM — We present a new optical method to measure the linear viscoelastic properties of materials, ranging from complex fluids to soft solids, within a large frequency range (about 0.1–10^4 Hz). The surface fluctuation specular reflection technique is based on the measurement of the thermal fluctuations of the free surfaces of materials at which a laser beam is specularly reflected. The propagation of the thermal surface waves depends on the surface tension, density, and complex viscoelastic modulus of the material. For known surface tension and density, we show that the frequency dependent elastic and loss moduli can be deduced from the fluctuation spectrum. Using a viscoelastic solid (a cross-linked PDMS), which linear viscoelastic properties are known in a large frequency range from rheometric measurements and the time–temperature superposition principle, we show that there is a good agreement between the rheological characterization provided by rheometric and fluctuation measurements. We also present measurements conducted with complex fluids that are supramolecular polymer solutions. The agreement with other low frequency and high frequency rheological measurements is again very good, and we discuss the sensitivity of the technique to surface viscoelasticity.

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