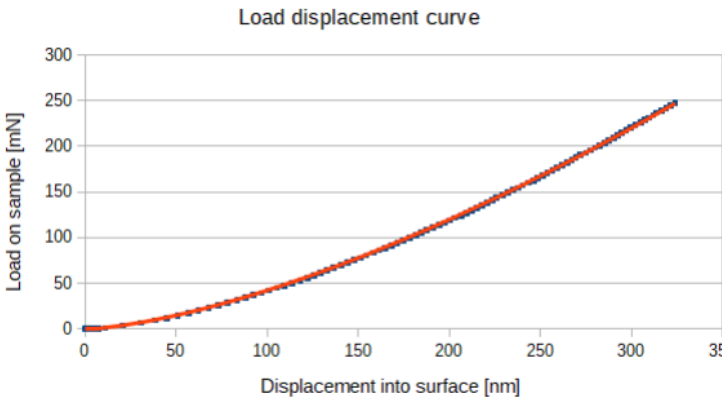
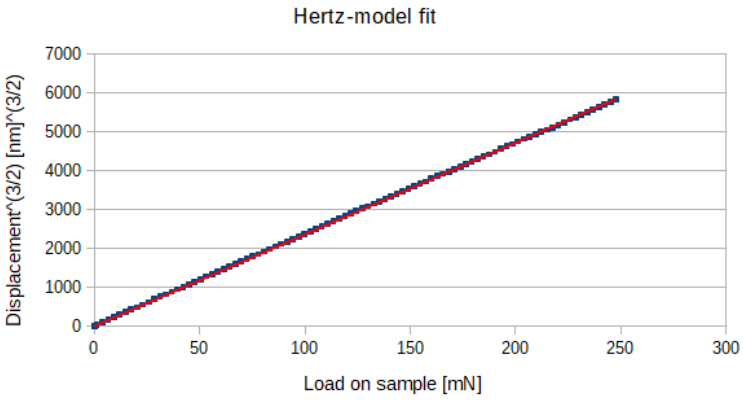
Dynamic testing with spherical tips

Since dynamic testing is a different approach to conventional loading/unloading or elastic modeling using the Hertz model, it is important to verify the validity of results. Here we demonstrate the results using a large sphere on fused silica. This combination responds elastically to the deformation and modulation of the force. Consequently we can compare the “pure” contact stiffness values.

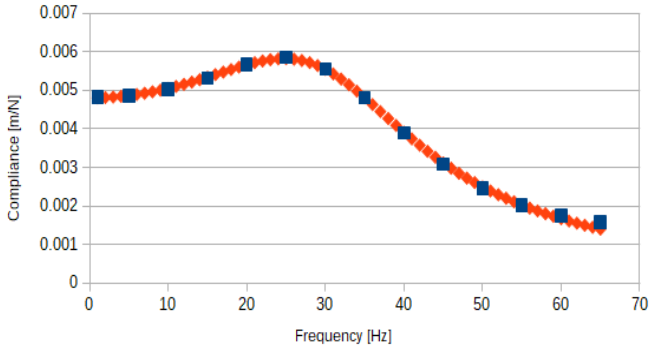
Modeling loading curves with Hertz model:





Loading data follow Hertz model from small loads up to high loads for a very stiff contact.
Fit curve using E = 72 GPa and R = 250.12 µm (250 µm nominally)

Dynamic testing using sm@rt 500:



Sm@rt transducer dynamics fitted to linear harmonic oscillator

Dynamic modulation and demodulation without additional hardware

Integrated in hardware and software

Frequency range 0.1 ... 65 Hz

Dynamic force range up to 600 mN (including static load)

DMA procedure for storage and loss modulus

Continuous determination of dynamic stiffness, phase angle, damping, modulus and hardness

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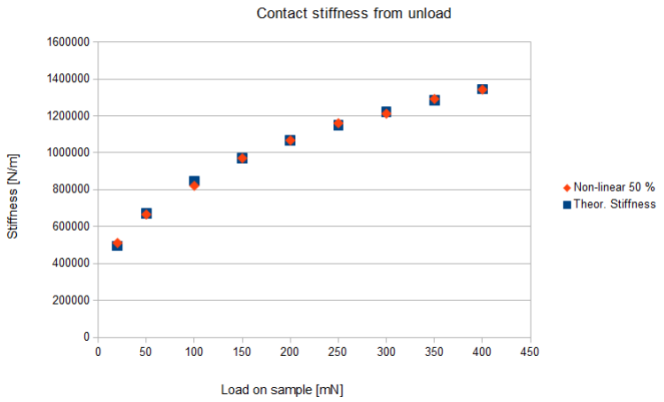
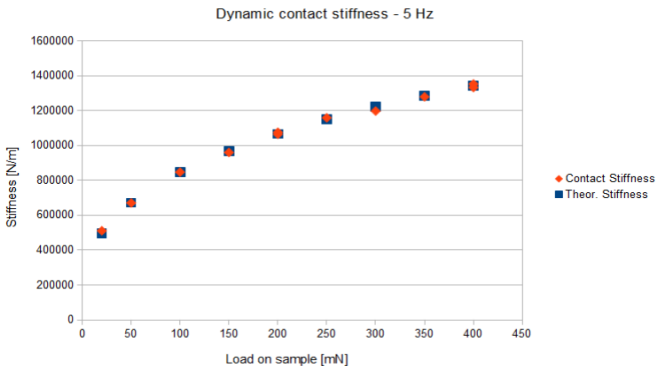
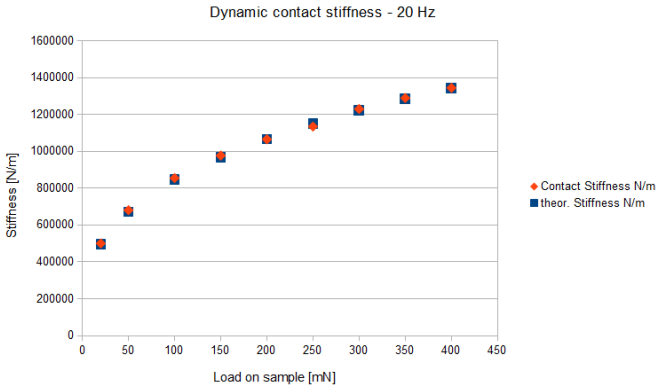
Unload stiffness, stiffness from Hertz model and dynamic stiffness

Comparison of stiffness values at a given load. Theoretical stiffness is calculated from the Hertz model using the derivative of the load with respect to displacement.

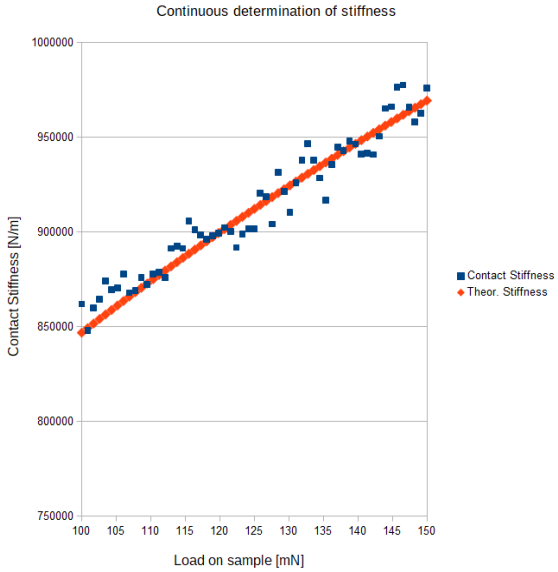
The stiffness from the nonlinear unload fit and the measured contact stiffness in dynamic mode agree very well with the elastic model. This demonstrates the quality of static and dynamic calibration of the instrument.

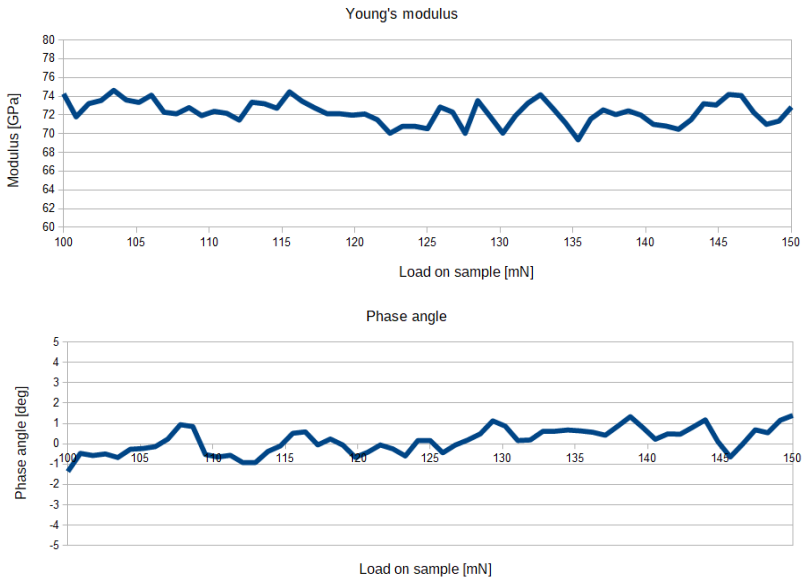






Force and displacement data are recorded unfiltered for flexible post test analysis. The data below show the result of a constant load ramp (50mN / 30s) using the same sphere as above at 10 Hz.





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