Speeding up an AFM measurement by altering the Q factor

Supervisors:

TNO	Maarten van Es
TU Delft	Hamed Sadeghian
TU Delft	Fred van Keulen

Duration:

1 Year

Introduction:

The AFM's that are used can create very detailed images of a surface, but to scan the surface can take a lot of time. The speed with which the surface can be scanned depends on various aspects. One of them is the Quality Factor (Q-factor). By altering this factor we could speed up a measurement. What is the best way to achieve this without contaminating the surface that is to be scanned?

Problem:

The scan speed of an AFM is linked to the Q-factor. By reducing the Q-factor the response of the AMF cantilever can be quicker. This can already be done by submerging the cantilever in a liquid. In this project we will try to find a way to reduce the Q-factor without contaminating the scan sample.

Description:

December 2014 - January 2015

The first step will be an introduction to AFM and the use of an existing instrument.

February 2015 – April 2015

You will work on further developing a custom tip and sample holder to enable this instrument to work in fluid. We already have a first prototype, but this needs further refinement to become truly practical.

April 2015 – June 2015

The next project is the immersion of the whole existing setup in a pressurized gas to lower the quality factor of the cantilever. Compared to fluid this will introduce much less contamination on the sample, an important consideration for applications.

May 2015 – August 2015

Another project is simulation and development of encased cantilevers. First we need simulations to assess how these cantilevers behave and which Q factor we can expect from various designs and liquids. Next we need an actual design that can be fabricated, perhaps including features like microfluidics to bring fluid in the encasing. Also design of a tip-holder to use with the microfluidics. It would be great if we can fabricate and test such encased tips here in Delft or perhaps in Twente, where there is experience with similar structures.

August 2015 – October 2015

Another interesting simulation is what happens to a cantilever tapping on a surface in a non-linear potential. We have some measurements of fast transient responses that we do not understand and

that may be clarified by such simulations. For this we would also like to do experiments with high speed data capture to verify the simulations.