nanosurf

Nanosurf (www.nanosurf.com) is a leading provider of innovative atomic force and scanning tunneling microscopes (AFM and STM). Our products and services are trusted by professionals worldwide to help them measure, analyze, and present 3D surface information. Our scanning probe microscopes excel through their compact and elegant design, their easy handling, and their absolute reliability. To support our R&D team in a cutting-edge collaboration project with ETH Zurich we are looking for a

Student Internship (or Master Thesis) in Cytomass Development for Life Science Applications (6-12 months, as of April 2021 or later)

About the Project

As an Intern / master student in R&D department, you will work 100% for Cytomass monitor project (https://www.nanosurf.com/en/products/cytomass)**.** The Cytomass monitor is a system to measure the mass of cells and small tissues under physiological conditions [1]. New research fields have been opened to investigate the relationship between cell mass and topics such as cell migration, viral infection, drug screening and more. You will work in collaboration with our university partner, the Biophysics Group of the ETHZ in Basel, led by Prof. D. Müller.

Task Description

Your task is to find a feasible solution to detect the position of the cell on the cantilever in real-time, using software- and/or optical-based approaches (Figure 1a). At the current stage, researchers manually draw circles around the cells in the postprocessing. The cells are sometimes hardly visible by eye (Figure 1b). Knowing the position is crucial for reliable mass measurement, as a change of cell position changes the sensitivity of the measurement. The cell movement is reflected in a shift of the resonance frequency of the cantilever, which is otherwise proportional to the mass of the cell (Figure 1c). Therefore, we have already started with the development of a multimode excitation approach [2, 3], which allows determining the cell position to some extend. Your task is to combine and extend this software-based approach with additional optical information.

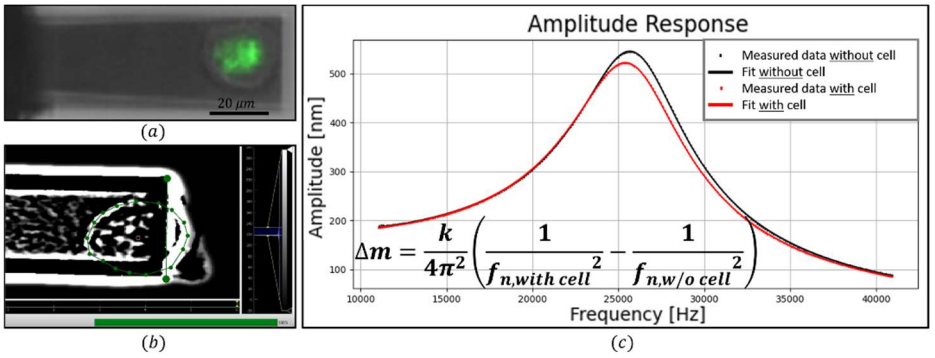

Figure 1: (a) Fluorescently labelled cell on a rectangular cantilever. The distance away from the edge of the cantilever needs to be determined. (b) Currently, the user needs to draw manually by hand (green doted lines) the outline of the cell to determine the center of mass for each image frame (c). The detected mass Δm is computed by using the spring constant k of the cantilever and the measured resonance frequency f_n before and after the cell attached.

Work packages

- Building on the previous work [3], extend the literature survey to identify additional software and optical tools to track the position of the cell also over multiple hours continuously.
- Develop and implement a feasible position tracking algorithm in a GUI framework.
- Evaluate your algorithm with a FluidFM cantilever (fixed position) and optical image analysis.
- Demonstrate your algorithm to the current researchers in the field.
- Present results at group meetings and write short reports.

Your background

We are looking for a student with background in computer science, physics, engineering, nanoscience or equivalent who wants to do an industry project as part of his or her master education. You should be familiar with Python and image processing tools (e.g. OpenCV). Basic knowledge of atomic force microscopy (AFM) or of cantilever-based measurement instruments is of advantage.

For more information, please contact Gabriel König koenig@nanosurf.com
Please submit your CV and a letter of motivation for this position to jobs@nanosurf.com

[1] Martínez-Martín et al. Nature volume 550, pages 500–505 (2017), doi:10.1038/nature24288
[2] Dohn et al. Review of Scientific Instruments 78, pages 103303 (2007), doi:10.1063/1.2804074
[3] Hans Gunstheimer, Improved mass calibration of an inertial pico-balance using micro-particles, master thesis, 2021

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