Characterization of the time-evolving bending profile of micro-cantilevers

Alstrøm, Tommy Sonne; Bosco, Filippo; Larsen, Jan; Bache, Michael; Brøgger, Anna Line; Frøhling, Kasper Bayer; Hwu, E. T.; Chen, Ching-Hsiu; Hwang, Ing-Shouh; Boisen, Anja

Publication date: 2014

Document Version
Publisher’s PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
CHARACTERIZATION OF THE TIME-EVOLVING BENDING PROFILE OF MICRO-CANTILEVERS

Tommy S. Alstrøm, Filippo G. Bosco, Jan Larsen, Michael Bache, Anna L. Brøgger, Kasper B. Frøhling, En-Te Hwu, Ching-Hsiu Chen, Ing-Shouh Hwang and Anja Boisen

Introduction

- We present the statistical analysis of IBM style 8 cantilever sensors that are chemically functionalized for sensing specific biomolecules using a DVD-ROM optical drive [1].
- Several micromechanical-based sensing tools have been verified by their detection capabilities [2].
- In this work, we present new insight on the behavior of cantilevers made possible using a fully automated system for parallel microcantilever-based biosensing and statistical analysis of data [3].
- We are detecting an inflammatory biomarker, Soluble Urokinase Plasminogen Activator Receptor (suPAR).

Cantilever surface analysis

- The AFM approach uses an optical leverage system with a spot size of roughly 30 µm, the DVD pick-up has a spot size of ~0.6 µm and scans ~2000 locations across each cantilever apex.
- Each suPAR experiment collects ~2 GB data, and using a MATLAB program anomalies are located and the response is calculated using clean areas only.
- The standard deviation of the points near the anomaly is more than one order of magnitude larger compared to the smooth areas.
- The collected data allows a more precise readout profile and provides a qualitative assessment of the sensor surface.

Signal integrity verification

- The static response over time can be visualized and the quality of the cantilever surface assessed.
- The surface of cantilevers can be rather inhomogeneous and it varies from cantilever to cantilever.
- However, cantilever responses are “quite” stable over time, and this allows both for reliable data integrity verification, as well as estimating static response in case of missing cantilever readouts.

Conclusions

- It is a great advantage to collect a multitude of data points, as this enables more robust data processing.
- The approach can be used to automatically verify integrity of data.
- The approach prevents that the presence of anomalies or data loss leads to misleading conclusions.
- We believe that it is paramount that cantilevers are scanned in multiple areas in order to ensure sensor reliability.