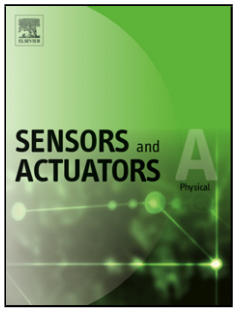

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Electromagnetic cantilever reference for the calibration of optical nanodisplacement systems

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Highlights

- A new solution for displacement reference utilizing electromagnetic cantilever is presented
- Proposed solution can be applied for systems lacking surface scanning capabilities (force sensing oriented systems)
- Full characterization of the proposed reference is provided and compared against FEM analysis
- Example application is presented in which Inverse Optical Lever Sensitivity of the uncalibrated system is calculated

Most commonly instruments utilizing cantilever-based sensors are equipped with optical beam deflection (OBD) detectors. The devices utilizing OBD setup are of simple construction, however it is quite difficult to calibrate their response. This is especially important for the instruments applied in biochemical investigation, where all the interesting phenomena happen within a fluidic cell. This limit comes from the fact than most common approach to calibrate an OBD system is to apply know deflection from a piezoelectric scanner and calibrate the OBD detector response. Here we present an electromagnetic cantilever reference which has the ability to overcome these limits. We show how its deflection can be precisely calibrated and then it can act as a transfer deflection standard. We do this by providing a calibration under known electromagnetic field and we analyze forces with a FEM model. We show that the proposed electromagnetic cantilever reference can be applied in a system with unknown response and accurately calibrate its response.

I. INTRODUCTION

Microelectromechanical systems (MEMS), is the technology of micromachines with moveable parts, whose displacement is controlled and detected electrically. MEMS solutions are becoming more and more important for the progress in scientific and technological investigations [1]. MEMS as small and light devices require smaller activation energy, offer faster response, higher detection sensitivity and resolution than their macroscopic counterparts. Application of a MEMS device in quantitative