

Embarked microscope for micro-indenter

Subject: Robotics

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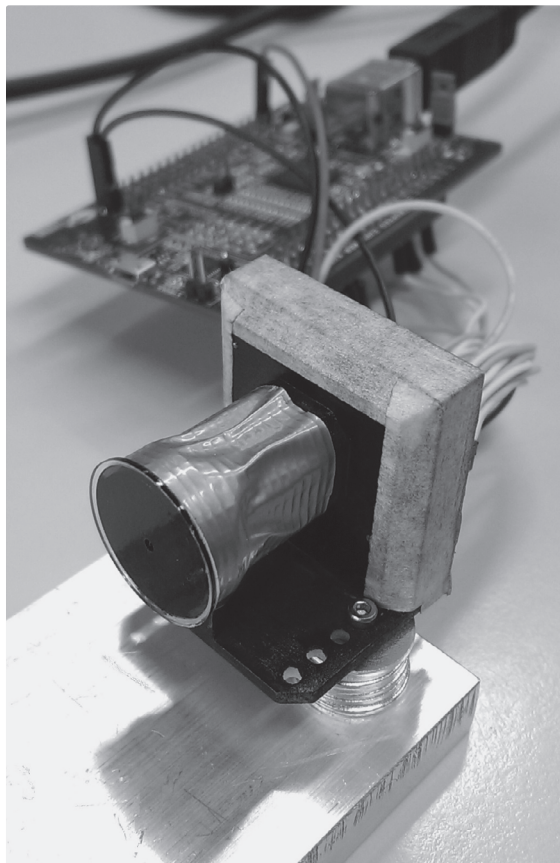
Project partner: Alemnis GmbH, Thun

In the last decades, nanoindentation has become the main process for measuring and testing very small volumes of materials. Alemnis GmbH produces an indenter specially developed to work in Scanning Electron Microscope (SEM) chambers. In other applications, where the SEM is not available, a small and lightweight microscope is needed to align the indentation tip to the sample. The goal of this project is to design this microscope and integrate it on the indenter's head.

Introduction

The SEM Indenter has been developed to work inside scanning electron microscopes but lately more and more customers are using it in other applications such as synchrotron beamline or simply in air on a laboratory table. For those applications, Alemnis proposes a commercially available microscope mounted on the indenter's head to align the indentation tip to the sample.

The aim of this bachelor project is to design a customized microscope with improved performances in terms of image resolution, size and weight. The electronics parts are developed by another student.



A testbench for lenses, CCD sensors and diaphragms.

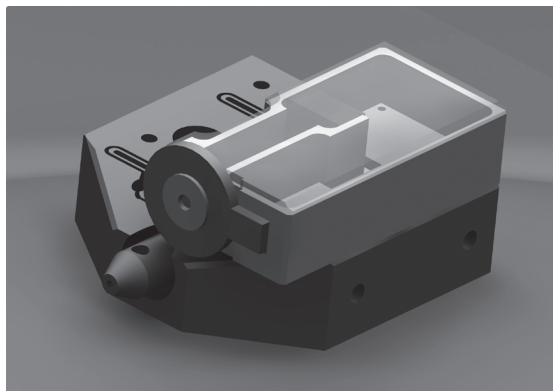
Materials and methods

A meaningful reverse engineering of the existing microscope was made, followed by the development and selection of the materials, optics, housing and mounting. In order to find the best optical configuration, some lenses and CCD sensors were tested out using two test benches created with rapid prototyping techniques. Further studies were conducted to propose solutions to the main challenges such as image quality, dimensions and weight.

Results and discussion

A working prototype has been built and assembled. The proposed solution to keep it small and lightweight was to split the microscope into two parts; a first housing mounted on the indenter's head with the bare essentials for image capturing and the second one with the main electronics and USB communication. The housing was designed to fit perfectly on the indenter's head and to keep a precise position while mounting and dismounting. The optic part consist of an achromatic doublet and a 1.92 megapixels CCD sensor.

In comparison to the commercially available microscope, this new one offers exactly the features needed by Alemnis and it also leaves a lot of space for future hardware extensions.



The final prototype, mounted on the indenter's head.



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