# Development of a Laser-based Position Sensing System

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| Status: | Filled |
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Background:
Optical detection is among the most sensing techniques for measurement of the displacements of an object. The goal of this project is to develop a laser beam bounce system that can detect the normal displacement of a microdevice.

Goal:
Micromechanical devices are exceedingly used in our daily lives. The small dimensions of these devices lead to minute displacements in the range of 10nm to 10  m. The goal of this project is to develop a laser beam bounce system that can measure out of place displacements with precision on the order of 1nm.

The system is composed of a laser beam and a photodetector that are placed on a solid frame to reduce the effects of environment vibrations. The microdevice is placed such that the laser beam reflects off its top surface onto the photodetector. Out of plane movements of the microdevice will change the location of the reflects spot on the photodetector, which can be measured electronically and related back to the amplitude of displacements.

Target performance:

- Operating frequency: DC to 1MHz
- Required precision: ~1nm
- Suppression of environmental vibrations

Deliverables:

- Mechanical structure of the system, including housing for the laser, photodetector, and sample holder, all with easy access;
- Adjustable laser/sample location;
- Analog electronic circuits for post processing of signal from the photodetector;
- Digital electronic circuits to transfer the data to the computer for post-processing/storage;
- A graphical user interface on the computer to display real-time data;

- Clear documentation of all the work including the software components.

Required skills:

- Analog circuit design
- Digital circuit design with microcontrollers
- Knowledge of MATLAB orLabView
- PCB design and assembly