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Micro-mechanical Sensor Based on Electrostatic Pull-in

The performance of micro electro-mechanical systems (MEMS) is based on deformation of their micro/nano components, due to the load that we want to detect. Among these components, a circular plate with fully clamped edge can provide a detection surface on one side, completely isolated from its sensing surface, on the other side. This allows for a wider range of electric readout techniques, particularly in a liquid environment.
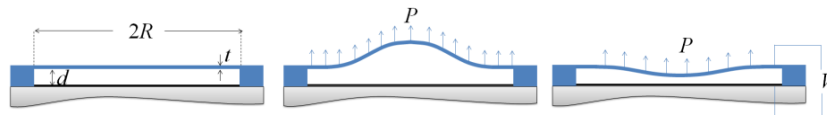
In general, electric readout techniques (capacitive, piezo-resistive or electrostatic pull-in instability measurements), within the framework of nano electro-mechanical systems, are favorable due to their high resolution and potential for high-volume and low-cost manufacturing. Within this class, the electrostatic pull-in instability, has been shown to be a robust method for characterization of mechanical properties of structures.

In this project we aim to introduce the pull-in instability of a fully clamped-plate as a readout mechanism for detecting any load which can create a deflection in the system. Major challenges of developing of such a sensor are complex mathematical modelling including electrostatics and mechanics, microfabrication, experimental setup for calibration.

This graduation project would be in collaboration with the PhD project: "Stability calibration of nano/micro plates", in SOM group.

Objectives:
- Designing a micro-mechanical sensor with a circular membrane as sensing component and electrostatic pull-in as sensing mechanism;
- Computational modelling to study the behavior of such a sensor under uniform pressure or in-plane resultants;
- Making the sensor;
- Calibrating the sensor with experimental setup.

Requirements:
We are looking for a candidate in the track of SOM or MNE, with strong experimental and analytical skills and able to work at the intersection of several research domains (structural mechanics, nano/micro engineering and multi-physical modelling).

Opportunities
- Work in a multidisciplinary research group within an international environment
- Become an expert in the field of nanomechanical sensing
- Learn how to carry out a literature study and how to give scientific presentations and professionally publish your work

Further information:
If you are interested in this project as your graduation assignment feel free to contact Banafsheh Sajadi (b.sajadi@tudelft.nl).