DESCRIPTION FOR THE GENERAL PUBLIC

Microelectromechanical systems (MEMS) forms a group of novel and modern structures, much smaller, lighter and faster than their macroscopic counterparts. These are small transducers, which work as mechanical to electrical signal transducers. The accuracy of this conversion relies mainly on that, how accurate is the element described. Staring from mechanical parameters: what is its stiffness, mass and a dumping characterisation. Even the stiffness alone (spring constant k) is very important. It shows what will be the bending of the investigated structure while acting the given force. So called "soft" object will deflect more, ridge – much less. What is more when driving this structure into its natural vibrations (resonance), its bending is increased many times, and how many – it is given by the parameter called quality factor (Q-factor).

However, here the intuition can fail. Taking a singly clamped beam (commonly known as a cantilever) as an example structure, it will turn out that while having a very low spring constant value, it may be characterised by very low Q-factor. Why? To get the answer one has to describe the cantilever with the use of dumped harmonic oscillator model. Then the mathematic solution will demonstrate, that the Q-factor is influenced by all mechanical parameters given above, i.e.: beside the stiffness also the mass and the dumping. As far the mass (depicted commonly as m) seems to be an obvious parameter, one can ask what is the dumping? This dumping parameter describes two effects: i.e. the vibrations' amplitude attenuation due to the beams' intrinsic stress and the attenuations caused by medium, in which the movement occurs.

Therefore, to understand the vibrating mechanical system's behaviour, its overall characterisation (giving all parameters) is necessary. In the literature, only methods for k-constant and the quality factor are widely described. So, the goal of the project is to develop the method and the technology, then constructing the set up for mechanical impedance determination and hence the stiffness k, the mass m and the dumping coefficient b of a sample MEMS structure.

As a method for the accurate vibration driving, photon force reference is proposed, i.e. the use of radiation pressure quantum phenomena (where the change in the momentum direction is a result of force acting). Although it can be seen as difficult, if one does not allow to reveal the other effects of light (or generally radiation) influence on investigated structure, photon force can be a very precise reference (calibration is planned).

It has to be highlighted that the developed method and technology will allow the overall MEMS behaviour's description, and be applied to any kind of MEMS in future.