Printed Acceleration Sensor

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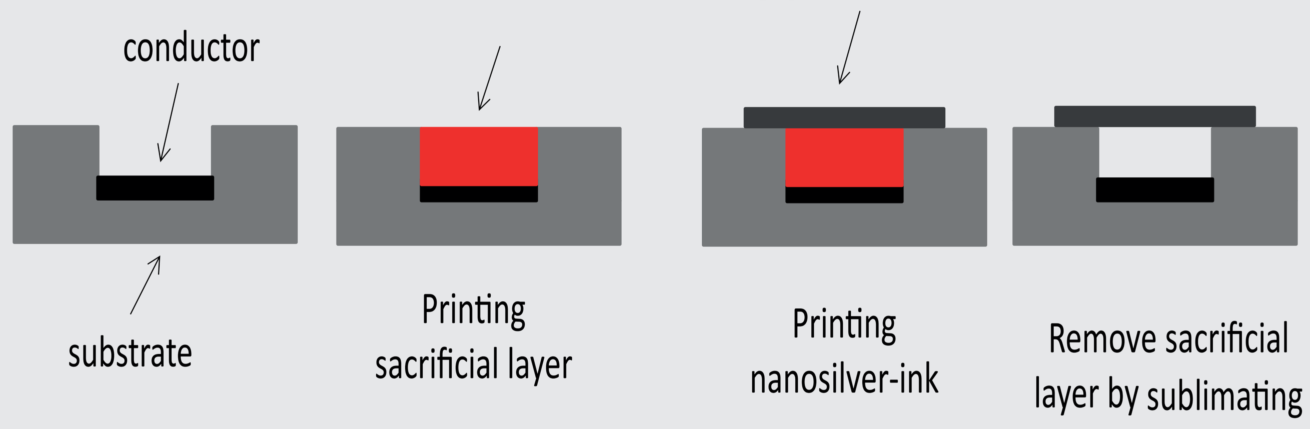
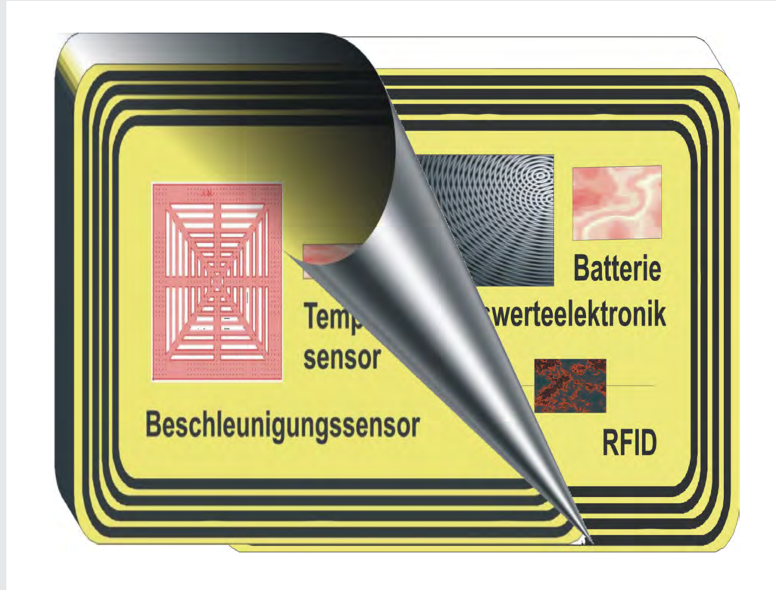
Project-Idea

Idea

- printed acceleration sensor with RF-readout
- capacitive acceleration-sensor-element
- using sacrificial layer technology to realize cavaties for movable parts of the sensor-structure
- applying of the sacrificial layer by inkjet-printing
- development of the RF-system and the sensor itself by FEM-simulation via Comsol Multiphysik

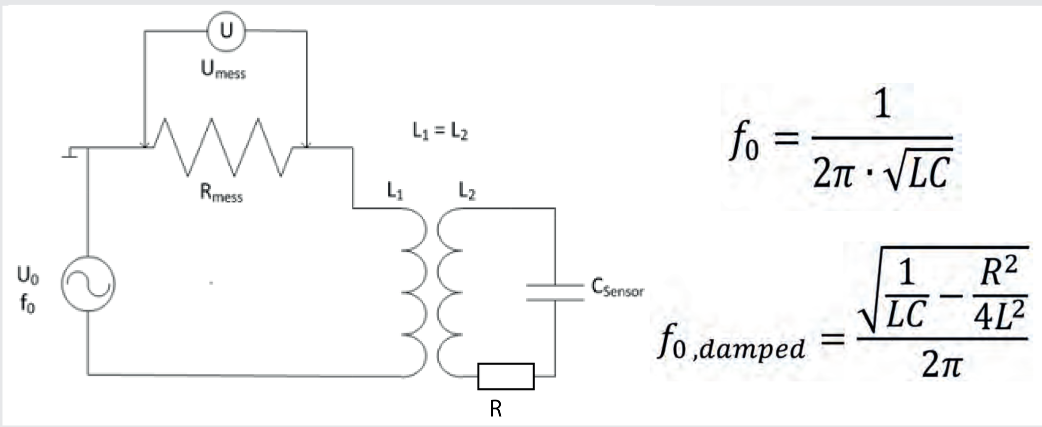
Technology

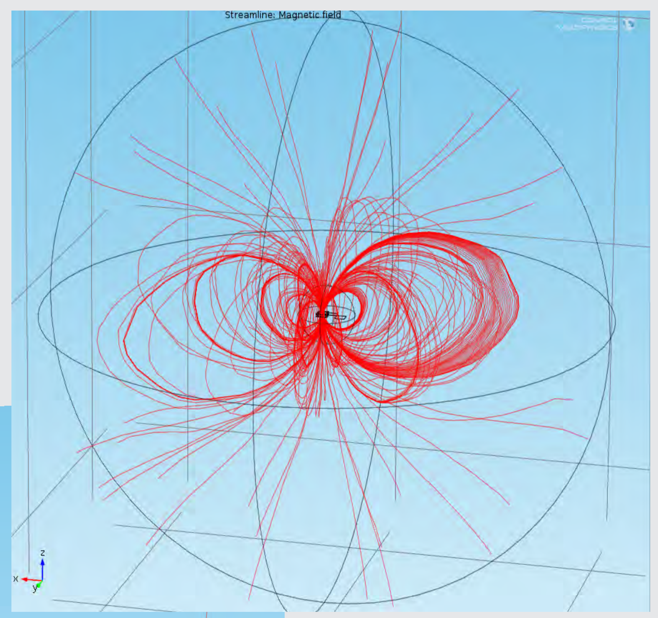


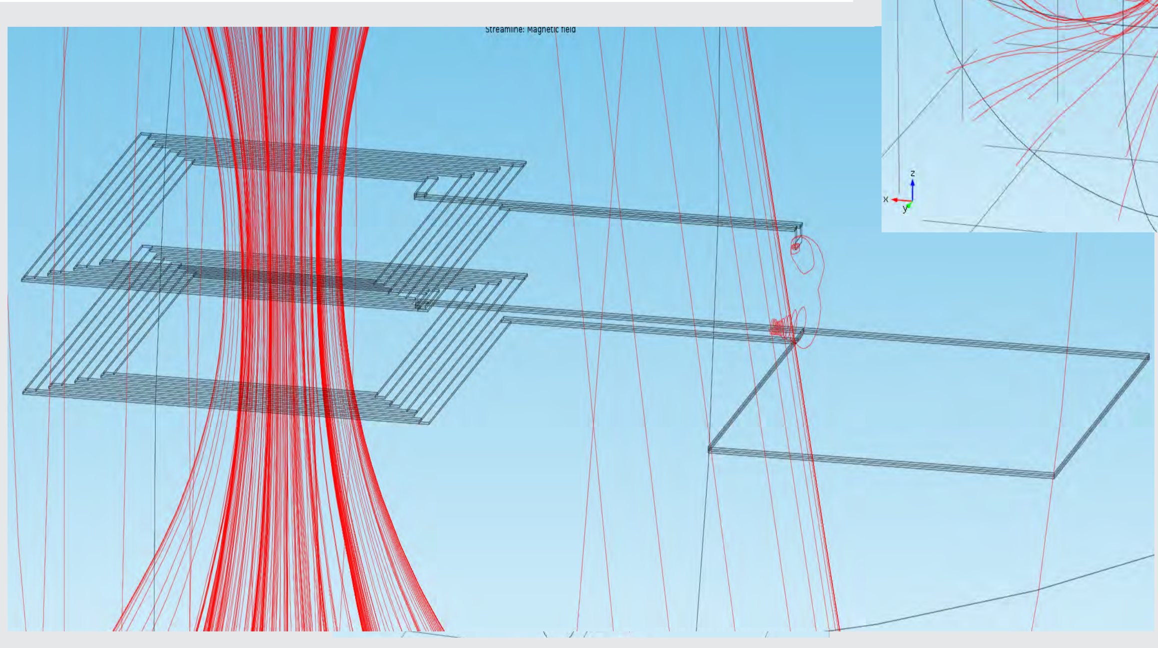


Printed sensor and evaluation electronics on foil

RF-Simulation

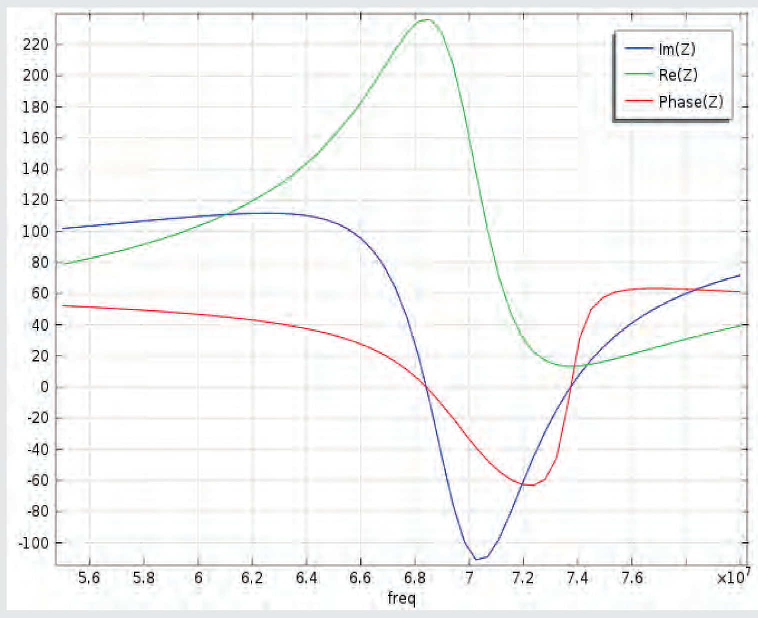






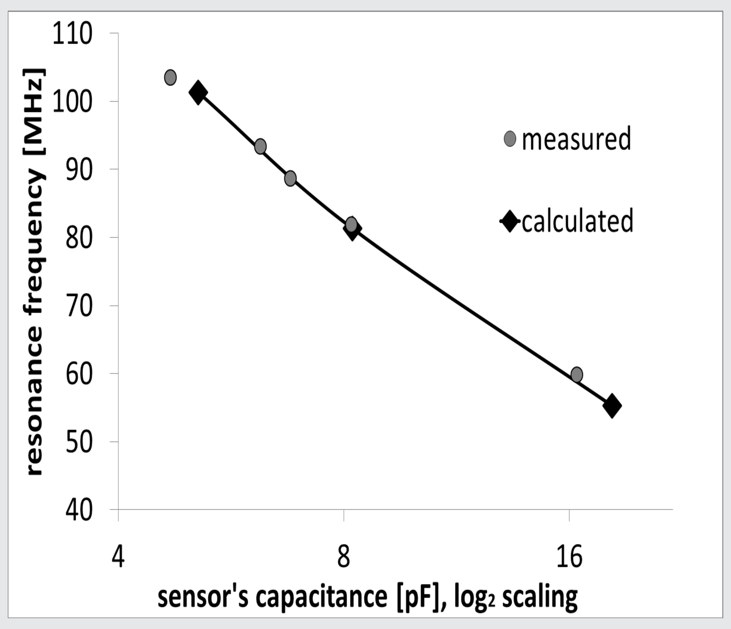
Magnetic field

Frequency Response



Result of the Z-parameter analysis at the lumped port over frequency. Real part of imoedance (green), imaginary part of impedance (blue) and phase of impedance (red).

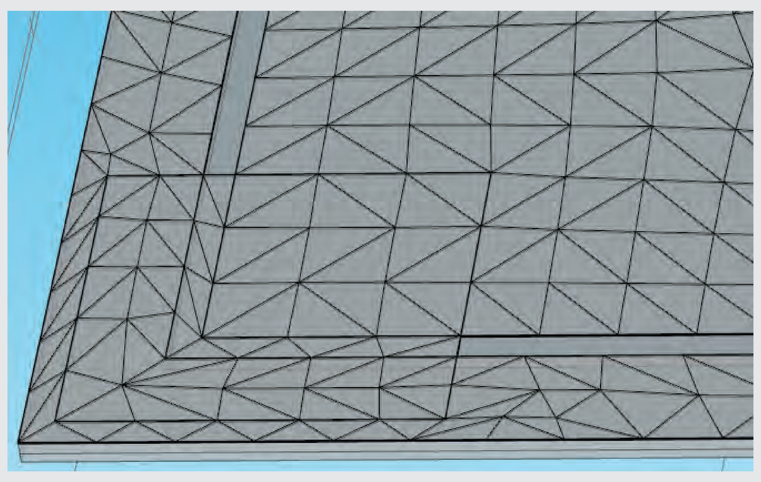
Resonance Frequen-

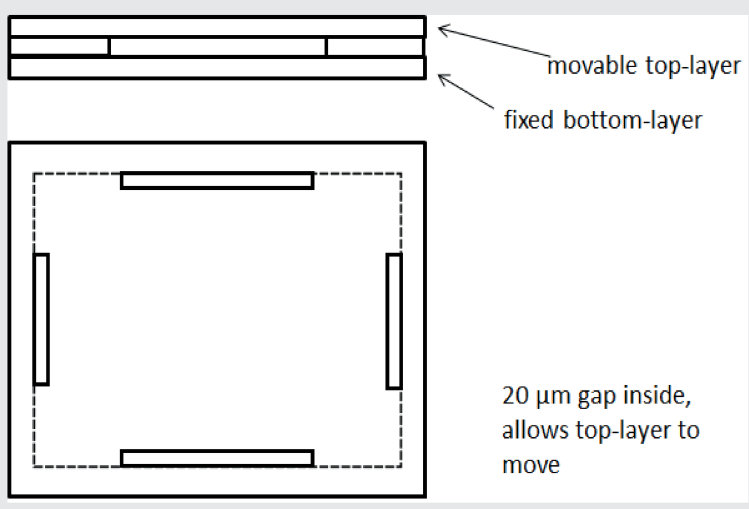


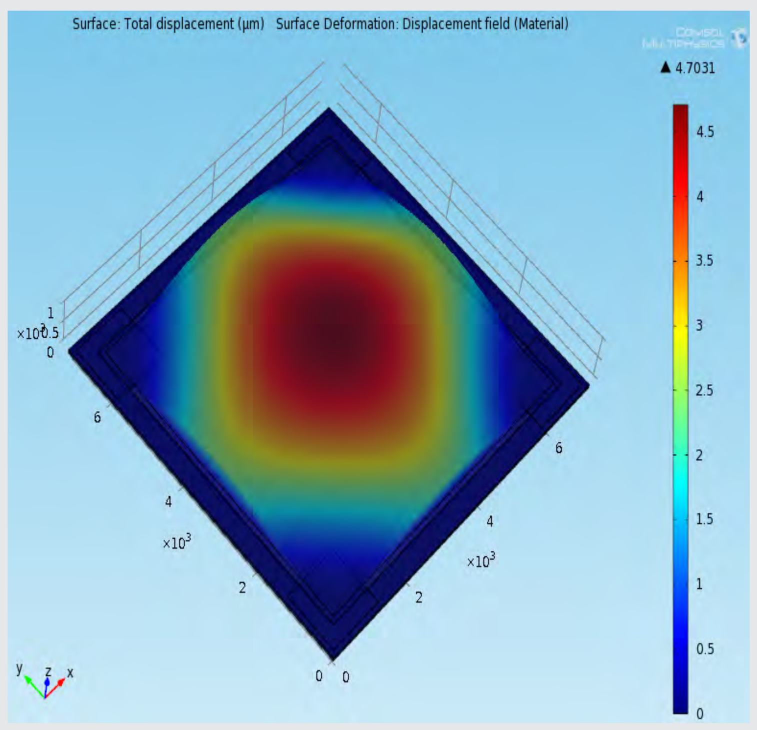
Plot of the resonance frequency over sensor's capacitance.

Structural-Mechanics Simulation

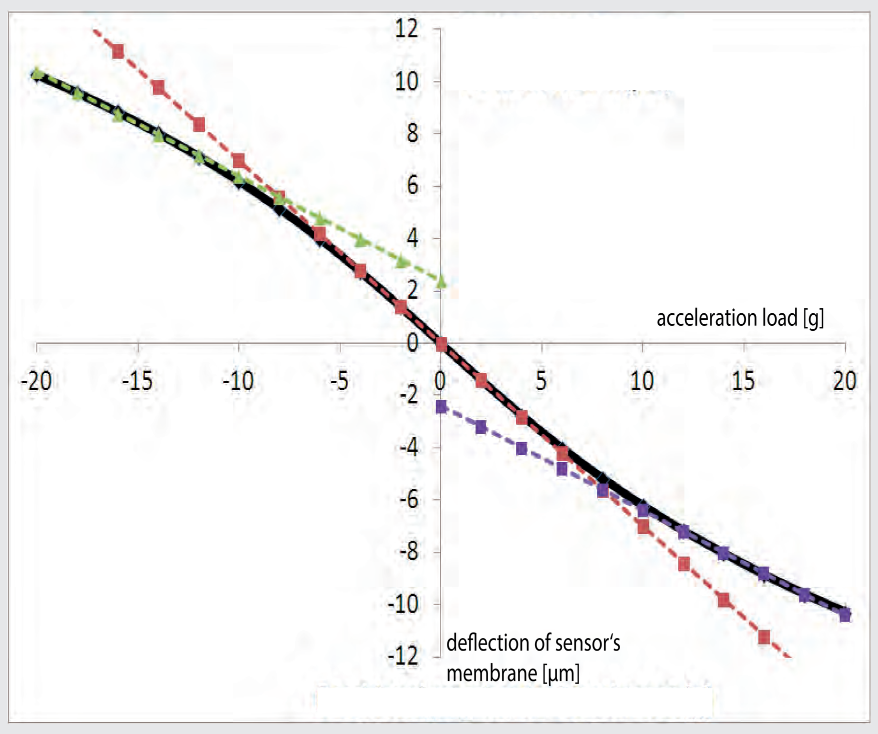
Coupling Nonlinear-structural-mechanics and RF-simulation via the ALE-method



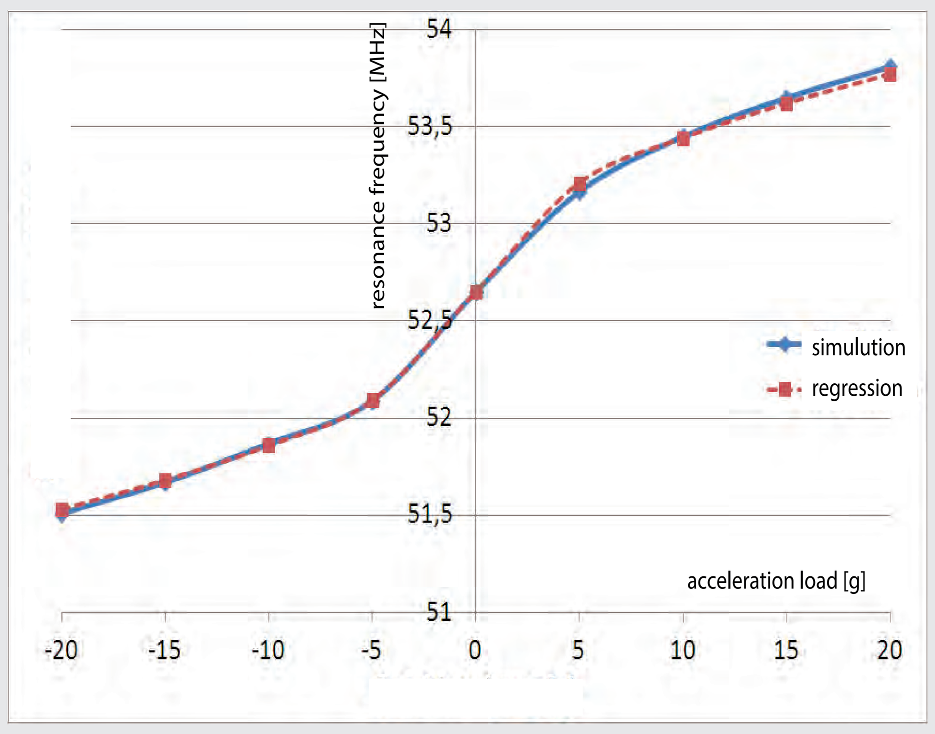




Deflection of the sensor's membraneafter acceleration load of -20g.

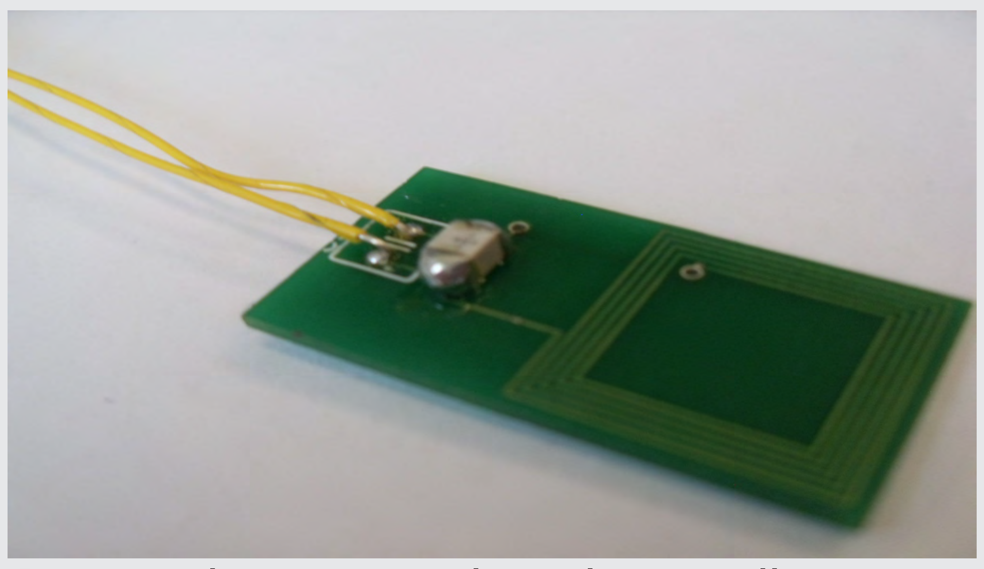


Deflection of the sensor plate. The green and purple line show the influece of non-linearity in geometry.



Characteristic Curve: Resonance frequency plotted over acceleration load. Regression: $f_0 = +-0.25 * \mathrm{sqrt}(|a|) + 52.65$

Conclusion



Sensor dummy produced according to the FEM-developed geometry. Sensor replaced by a HF-capacitance.

- sensor-system designed by FEM-Method with Comsol Multiphysics
- calculations verified by measurements
- a change in resonance frequency of ca. 2.25 MHz is achived by an accereration of + 20 g
- calculating the mechanical stability of the printed sensor element

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