DESIGN AND MODELIZATION OF ELLIPTICAL SHAPE ELECTROMECHANICAL RESONATORS FOR RF-MEMS APPLICATIONS

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Nowadays, the transfer of information via telecommunication channels is part of our routinary way of live. For this reason, the systems that play a role in this feature are object of multiple kinds of investigations and produce an important amount of publications.

The use of electromechanical devices as a component of RF systems (RF-MEMS, i.e. filters, switches, reference and voltage-controlled oscillators, etc…), constitutes an emerging field into these investigations. Researchers have explored some kind of structures, searching for a better quality resonator, with a great quality factor and adequate coupling parameters. Structures like beams, squares and circles are extendedly studied.

In our work, we propose a laterally resonant structure based on an elliptical geometry. Firstly, mechanical calculations have been performed by the finite element method based solver COVENTOR [ref1]. From these simulations, mechanical parameters as resonance frequency, Q-factor, equivalent effective mass and equivalent spring constant have been extracted,. These simulations have been complemented by an electro-mechanical model developed to simulate these kind of resonators on an analog circuit design platform. This model takes into account the deflection shape obtained by COVENTOR when applying an external electrostatic force and also allows to simulate simultaneously the MEMS system with its read-out circuitry.

Also we propose and tested the way for fabrication of elliptical resonators with dimensions for natural frequencies in the range from 100 MHz to 1GHz and small gap (down to 100 nm) via photolithography or Electron Beam Lithography.

From our results we can conclude that the elliptical resonators, with small gaps, are a good way to obtain a good quality factor and coupling constants with no complex geometry and fabrication methods. The sizes for natural frequencies like 100 MHz or 1 GHz (demanded from transmission protocols) and gaps down to 100 nm width, could be achieved by photolithography or EBL techniques.

[ref1] www.coventor.com