Tunable acoustic filters for space applications

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This work presents initial findings on the development of network topologies to obtain tunable filters based on acoustic resonators for prospective use in space applications. The proposed topology is based on fixed electroacoustic resonator with the insertion of tunable external components, in particular tunable capacitors.

The design of these filters also incorporates commercially available varactors, a critical aspect as their tuning range dictates the overall adjustability of the filter along with the electroacoustic coupling of the resonator. SH0 mode resonators in YX36-Cut $LiNbO_3$ (300nm) are selected due to their very large coupling values. Some of the resonators have been measured at the laboratory, and equivalent circuit models have been generated to emulate the varactors response. These circuit models are integrated into the design to assess their impact on the final filter response. Fig 1 illustrates the measured admittance response of a resonator around 1 GHz, with an inset showcasing the SEM image of the resonator. In Figure 2, the inset outlines the filter configuration, including varactors and DC-bias, along with detailed information about the circuit model of the component. Simulated results have been obtained using circuit analysis commercial software tools. Figure 2 displays the simulated circuit responses of the filter at the lowest (solid) and highest (dashed) tunability range, considering both resonator losses and varactor losses.

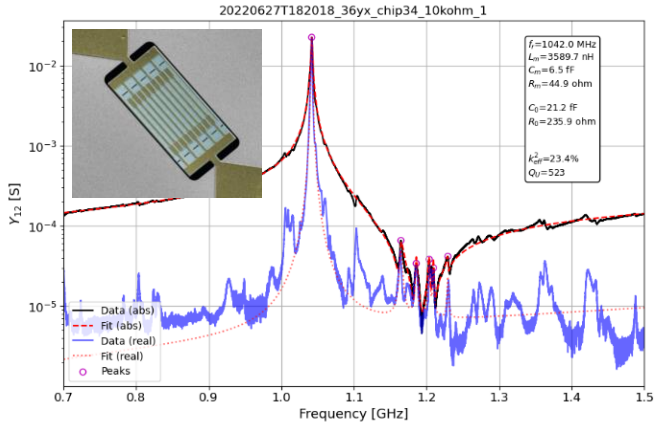

Fig 1: Mesured response of a resonator at 1 GHz.

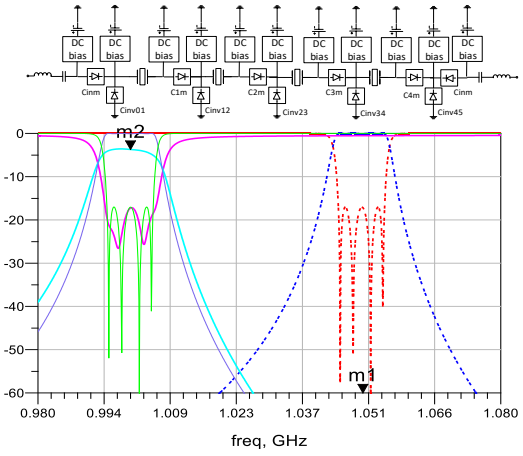

Fig 2: Lowest (solid) and highest (dashed) frequency response of the tunable electrically coupled acoustic topology for the synthesized and designed response