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ITI - Acoustic Transversal Filters

This work has been performed in the frame of an Innovation Triangle Initiative (ITI) and describes a joint collaboration between UPC, QORVO and ESA for the development of verywideband filters based on electroacoustic technology. To achieve this responses a novel filter configuration has been proposed and developed, resulting in a transversal filter topology. In contrast with the most standard filter implementation in acoustic technology, ladder configuration, the filter response does not depend on the so-called electroacoustic coupling coefficient, allowing to achieve acoustic filters with arbitrary position of transmission zeros and bandwidth. The methodology proposed also allows for controlling the impedance of the resonators and their resonant frequencies.

The activity consists on describing all the mathematical procedure for the synthesis of transversal filters with the special emphasis on the non-dependence with the electro-acoustic coupling coefficient. An additional circuit transformation procedure is used to define the filter designing curves where the resonant frequency of each resonator of a given impedance can be selected individually. This allows synthesized filters where all resonator have equal impedance (size) or simple set the resonant frequencies of the resonators in a feasible manufacturing range.

The activity continues by performing an accurate analysis of the practical implementation of a transversal filter, as is the sensitivity with the resonant frequency of the resonator, the losses of the resonators and external components and the effects of deviation in the resonator impedance. Finally the effects of having a non-ideal balun is also considered.

The project concludes by the synthesis, desing and implementation of a first prototype. The presented filter offers a fractional bandwidth and centred close to 4 GHz, being the first presented prototype in transversal topology.

The development is generic although the main application is related to Telecommunications.

ESA Technical Officer

Petronilo Martin Iglesias

Primary authors: Prof. MATEU, Jordi; Prof. COLLADO, Carlos (Universidad Politecnica de Catalunya); Dr AIGNER, Robert (Qorvo)

Presenter: Prof. MATEU, Jordi