Acoustoelectric Conversion Function: Properties and Computation

Abstract

In the quasi-static approximation, properties and calculation of the acoustoelectric (electroacoustic) conversion function for unapodized and apodized periodic SAW transducers are discussed. The basic closed-form equations for the acoustoelectric conversion function of an unapodized SAW transducer are deduced in terms of finger potentials and gap voltages. The results are generalized to the case of apodized SAW transducers, with the finger taps and gap overlaps properly defined. Merits of using the gap overlaps against the finger taps are discussed in details.

To suppress electrostatic end effects, the guard equipotential electrodes are added at both SAW transducer sides. It is shown that contrary to the wide-spread opinion these guard electrodes may give non-negligible contribution to the overall acoustoelectric conversion function calculated in terms of finger taps, in general case. The known equations are correct only in the particular case of the grounded guard fingers with zero potential at both transducer ends. These equations fail to predict the correct results for antisymmetric or non-symmetric transducer structures, the correction terms required in this case. Using the gap taps instead of the finger taps insures zero contribution of the guard electrodes regardless the SAW transducer apodization pattern, that fixes automatically the problem with guard electrode contribution to the transducer response. The comparison of both tap types is illustrated by examples of misuse and correct use of the finger taps in practical SAW filter design.

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