Abstracts

Diffraction analysis of slanted-finger interdigital transducers

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For analysis, slanted-finger interdigital transducers (SFITs) are usually divided into many channels in parallel to the propagation direction. Every channel is considered to be a subfilter. This procedure neglects the diffraction completely. This paper introduces the diffraction in the SFIT analysis by use of the angular spectrum of plane waves (ASPW) approach. The analysis is based on a one-component bulk-wave model. The integrals of an ASPW are carried out by summing up M wave components with various wave vectors. Two wave modes propagating toward both forward and backward directions within SFIT are assumed to take the coupling effect into account. The amplitudes of both wave modes are expressed by M-dimensional vectors. By means of the boundary conditions at every finger edge, the transfer matrix and transduction vector are found. As a result, coupling-of-modes-like equations that link wave components at adjacent finger and gap regions are obtained. By matrix-matrix and matrix-vector multiplication, the complex amplitudes of all the wave components in all the finger and gap regions are calculated. These amplitudes yield the total wave field including reflection at all fingers. The wave field yields the piezoelectric part of the input and output transducer currents as functions of the filter input and output voltages representing the piezoelectric part of the Y matrix. The model is used for analyzing a unidirectional SFIT filter, the transducers of which are composed of SPUDT cells on 37/spl deg/ YX quartz. The simulated transmission behavior is compared with experimental results. Good agreement is found. Especially for the case of a large slanted angle, the profound deformation appearing within the passband and the high-frequency transition band can be clearly identified as the most important influence of the diffraction on the transmission behavior.

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