

BRIEF NOTE

NEW DISPERSIVE IDT

E. DANICKI

Institute of Fundamental Technological Research
Polish Academy of Sciences
(00-049 Warszawa, ul. Świętokrzyska 21)

A new structure of interdigital transducer (IDT) of surface acoustic waves is proposed having useful property as concern the overtone frequency response. The proposed transducer utilizes both dispersive aperiodic system of electrodes, and apodization.

Let us consider a chirp signal with a time-duration T and a passband B ,
 $t \in (-T/2, T/2)$

$$h(t) = \sin \phi(t), \quad \phi(t) = 2\pi \left(f_0 + \frac{B}{2T} t \right) t \quad (1)$$

A typical dispersive IDT has its electrodes placed at $x_n = vt_n$ on the substrate surface, where

$$\phi(t_n) = n\pi \quad (2)$$

It is well known that the frequency response of such transducer can be severely spoiled due to the Bragg reflection of SAW from transducer fingers [1]. To avoid that, one may use split fingers applying $\pi/2$ instead of π in Eq. (2). Below we propose yet another method.

Consider the signal $h(t)$ superposed on another chirp pulse h'

$$s(t) = \sin 2\pi \left(f_0 + \frac{B}{2T} t \right) t + \sin 2\pi \left(f'_0 + \frac{B'}{2T} t \right) t = 2 \sin \phi'(t) \cos \phi''(t) \quad (3)$$

$$\phi' = 2\pi \left(\frac{f_0 + f'_0}{2} + \frac{B + B'}{4T} t \right) t, \quad \phi'' = 2\pi \left(\frac{f'_0 - f_0}{2} + \frac{B' - B}{4T} t \right) t$$

The corresponding dispersive IDT will have electrodes placed accordingly to Eq. (2) but with ϕ' replacing ϕ ; the apodization of the transducer is described by $\cos \phi''(t_n)$. The local wave-number of strips is $2d\phi'/dx$, $x=vt$ (the factor 2 is the consequence of Eq (2)). Note that applying suitable f'_0 , the synchronous Bragg reflection is removed from the DDL passband. This is because the x -dependent local wave number of strips is shifted to $2\pi(f_0+f'_0)/v$ while the Bragg condition requires its value equal double SAW wave number, that is $4\pi f_0/v$.

The advantage of the proposed structure (several others can be devised in similar manner, generally h' should be a passband signal; if $f'_0=3f_0$ and $B'=3B$, we obtain split fingers, if $B'=-B$, we obtain a dispersive IDT having periodic fingers with apodization [2]) is two-fold

- the above-mentioned reduction of Bragg reflections,
- and additionally if $B'=0$, the introduced passband is of $\sin x/x$ shape placed at the chosen frequency f'_0 . This spurious passband is easily rejected from the filter passband with help of the properly chosen second IDT of the filter.

This particular case is shown in Fig. 1, where the amplitude response of the sample dispersive IDT was calculated applying $B'=0$ and $f'=f+2B$. The fundamental, and the overtone passbands are shown.

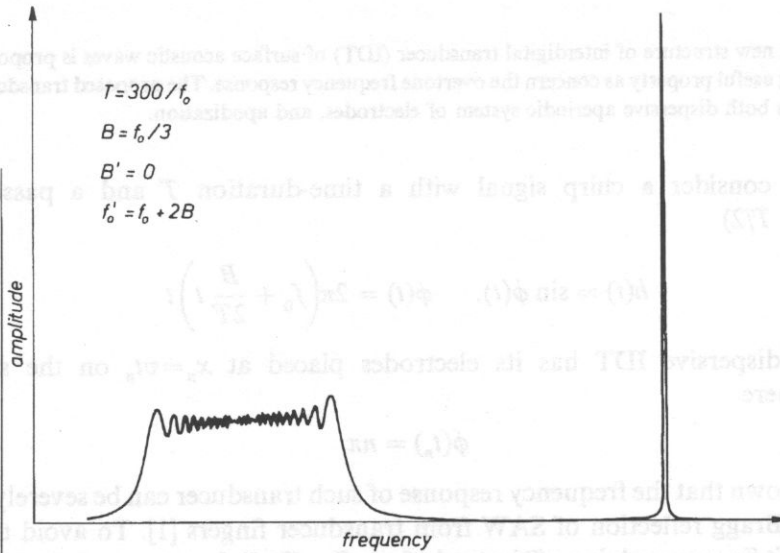


Fig. 1. Amplitude-frequency response of a dispersive interdigital transducer having aperiodic electrodes with apodization.

As concern the theory of the proposed transducer, that presented in [3] can be particularly useful as it allows to analyze nearly periodic electrodes which are the most common cases in dispersive filters.

References

- [1] B. LEWIS, R.G. ARNOLD, *Electrode reflection, directionality and passband ripple in wideband SAW chirp filter*, IEEE Trans., SU-32, pp. 409–422 (1985).
- [2] J. FILIPIAK, A. KAWALEC, E. DANICKI, *Wide-band SAW dispersive filter with a flat amplitude response*, Ultrasonics, 28, pp. 355–357 (1990).
- [3] E. DANICKI, *Generation and Bragg reflection of SAW in nearly periodic system of elastic metal strips on piezoelectric halfspace*, J. Acoust. Soc. Am., 93, 116–131 (1993).

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THE FIFTH SYMPOSIUM ON SOUND ENGINEERING AND MASTERING

The Symposium has been organized in common by the Institute of Telecommunication and Acoustics of the Wrocław Technical University, and the Polish AES Section. The debates were held from the 8 till the 10 September 1993 in a conference centre, lovely situated in a garden quarter of Wrocław city, its northwestern part.

At the opening ceremony Andrzej Góssenski, the Symposium chairman, directed his welcome address to the 73 participants, section members and invited guests. Especially warmly he greeted Gerhard Senkx — AES Vice President for Region Europe, as well as Marianna Szymczak — Chairperson of the Polish AES Section, and Włodzisław Młynarski — Vice Rector of the Wrocław Technical University. With particular attention was received Mr Senkx's address, where he emphasized the need for cooperation and support for the new organized AES Sections in Central and Eastern Europe. His greetings and wishes for the further development of the Polish Section were warmly accepted by all participants.

A growing interest in sound engineering and sound mastering among people professionally active in this field, created recently a favourable situation for the development of the Polish AES Section. After its Fourth Symposium, the Polish AES Section was more and more active. The number of Section members overpassed one hundred. Their participation in the AES Conventions in Vienna and Berlin was noteworthy, in relation to both the number of participants and of contributed papers. Polish Section activities were reported in several issues of the Journal of AES. Our contacts with professional colleagues from abroad improved. Recently our organization has been affiliated with the Committee on Acoustics of the Polish Academy of Sciences. A close cooperation with the Polish Acoustical Society is maintained.

However, further progress in our activities is highly desirable. The program of the Fifth Symposium has not met the actual demands of our society. Namely, it improved direct contacts among scientists and businessmen, working in the field of sound and vision, and created our Section's direct link to the audio industry in Poland. Therefore, the Wrocław Symposium was purposely organized in parallel to INTERMEDIA '93, the largest Polish exhibition and fair on audio and video products. As INTERMEDIA '93 was only a few hundred meter away from the Symposium site, and Symposium participants' badge ensured free entrance to the fair area, so, all participants were able to visit numerous stands of that nicely outfitted audio exhibition.