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Surface acoustic wave devices.

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Acoustics Research and Technology. Hauppauge, NY: Nova Science Publishers (ISBN 978-1-63485-368-2/hbk). ix, 177 p. (2016).

The book contains a detailed description of mathematical, technical and physical issues related to the development, formation, and study of surface acoustic waves (SAW) devices. It considers the state of research in this area, methods of calculation and formation of such devices, their characteristics, original technical solutions and examples of application of SAW devices. Moreover, this book summarizes many-years experience with SAW devices, presents original approaches to the solution of technological problems and develops different designs of SAW devices, protected by Russian patents. Additionally, some results of experimental studies of SAW devices are presented.

The book is divided into eight chapters. The first chapter presents a brief description of using the acoustic electronic SAW devices in different systems and communications. Moreover, the technologies of radio-frequency identification (RFID) based on SAW devices are given. SAW sensors are discussed together with the methods of their research. Interdigital transducers (IDTs) are in the center of Chapter 2. This chapter presents a 1D model of SAW excitation and reception. Moreover, the unidirectional IDTs with internal reflectors and devices of frequency selection are discussed with their calculation and application in band-pass filters. IDTs with stepped electrodes, which operate at spatial harmonics, are considered, as well as three-phase IDTs. Chapter 3 presents interdigital directional couplers (IDDCs), used in frequency-selective SAW devices, in particular, in order to increase out-of-band attenuation in band-pass SAW filters. Chapter 4 is devoted to fan IDTs and to the corresponding SAW filters. In particular, TV-SAW filters of IF-path are studied and developed based on using different materials for films and substrates. Chapter 5 discusses SAW resonators and impedance filters and presents the corresponding test results. SAW sensors and RFID devices are studied in Chapter 6. Here, SAW sensors include temperature and pressure devices, antenna with SAW delay line and displacement sensor, and also RFID tags. Chapter 7 describes other SAW applications, in particular connected with non-destructive testing and acoustical-optical studies and experiments. The final Chapter 8 treats manufacture technology of SAW devices, including the corresponding piezoelectric materials and technological operations of preparation of films and substrates for SAW devices.

As a whole, this monograph will be useful to specialists associated with design, calculation, research and use of the SAW devices, as well as to graduate and undergraduate students specializing in applied mathematics, radio physics, information technologies, and modern engineering.

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