MATLAB SAW Filter Analysis Toolbox (SAWFAT): Algorithms, Structure, Examples

Abstract

This lecture provides a detailed overview of the author's *MATLAB®* Surface Acoustic Wave (SAW) Filter Analysis Toolbox (SAWFAT) for the design and analysis of IF SAW filters. SAWFAT is a collection of software tools intended for comprehensive simulation of in-line and dual-track SAW filters in the quasi-static approximation. In addition, the toolbox optionally supports accurate modeling of multistrip couplers (MSC) in dual-track SAW filters.

First, SAW component models, basic software functions, folder structure and organization re discussed. Basic modeling assumption is that bidirectional SAW interdigital transducers (IDT) is periodic (has a constant period and electrode width) and non-reflective if short-circuited (quasi-static approximation). For MSC modeling, two-modes approach (expansion into symmetric and antisymmetric first order rectangular modes) is applied.

Furthermore, the lecture reviews modeling assumptions, toolbox capabilities, software limitations, and computational principles underlying the implemented algorithms. In particular, the lecture explains the purpose, syntax, input arguments, algorithms, and practical use of the main computational subroutines.

To improve computational performance and reduce simulation time, the most computationally intensive functions are implemented in C or Fortran as MEX-files callable directly from MATLAB. Moreover, the toolbox includes source codes of both the gateway programs and computational subroutines, which allows users to customize the toolbox for specific applications and customer requirements.

The lecture also explains compilation, linking, and building of MEX-files and provides all information required to configure the system and build MEX-functions from the supplied source codes.

Finally, the lecture presents several tutorial examples together with representative simulation results. In addition, the lecture explains the format of the input data and provides sample data files, which enable users to adapt the examples to their specific requirements or create custom data files for analysis of user-defined SAW filters.

Contents

Web version: *MATLAB SAW Filter Analysis Toolbox (SAWFAT)*