

Bulk Acoustic Waves (BAW) Experience

Dr. Alexander Rukhlenko, SAW/BAW Consultant

1. FBAR Modeling and Simulation

Dr. Alexander Rukhlenko's BAW experience includes modeling, simulation, programming, and software maintenance in the field of computer-aided design of Film Bulk Acoustic Wave Resonators (FBARs).

He possesses a profound understanding of acoustic wave propagation in solids and multilayer structures, acoustoelectric equivalent-circuit modeling, and dispersion diagram analysis. As a result, he contributed to practical BAW modeling and simulation techniques. These techniques were implemented in [MATLAB®](#) and [Keysight® PathWave Advanced Design System \(ADS\)](#).

In particular, he implemented Mason equivalent-circuit models for thickness-mode and lateral-field excitations. He also developed fast algorithms for FBAR impedance calculation using these models in MATLAB and ADS. Furthermore, he developed numerically stable cascading techniques for multilayer stacks based on transfer-matrix methods. Additionally, he programmed MATLAB tools for dispersion diagram calculation and analysis.

One notable achievement was the development of a universal interface for direct integration of MATLAB models into Keysight ADS. As a result, he managed to incorporate into ADS design workflows user-defined MATLAB FBAR models and libraries. Moreover, the implemented C/C++ interface is highly versatile and sufficiently generic to support a wide range of applications. Furthermore, it is extendable to support complex user-defined MATLAB models in other fields.

While developing the ADS–MATLAB interface, he focused on flexibility, maintainability, and long-term usability across MATLAB and ADS versions. For efficiency and compatibility, parts of the MATLAB algorithms were reimplemented using ADS Application Extension Language (AEL).

2. BAW Experience in Software Development

In summary, his MATLAB and C/C++ BAW experience includes:

- C/C++ interface for integration of MATLAB FBAR models into Keysight ADS
- Development of custom ADS Process Design Kits (PDKs) with integrated MATLAB FBAR models
- Design and simulation of BAW devices:
 - BAW Solidly Mounted Resonators (SMRs)
 - Coupled Resonator Filters (CRFs)
 - Double Bulk Acoustic Resonators (DBARs)
- Development and maintenance of FBAR modeling software (C/C++, MATLAB)
- Software for dispersion diagram calculation and analysis
- Dispersion analysis of arbitrary BAW multilayer stacks
- Mason model simulation of FBARs and SMRs

3. FBAR Characterization and Analysis

- Characterization of multilayer FBAR stacks
- Visualization, analysis, and characterization of FBAR measurements

Dr. Alexander Rukhlenko also provides a series of advanced BAW lectures covering device theory, modeling, and computer-aided design. Therefore, his experience can be applied to consulting, education, and advanced R&D in BAW and FBAR technologies.

Web version: [BAW Experience of Dr. Alexander Rukhlenko](#)