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On-Wafer Calibration Techniques Enabling Accurate Characterization of High-Performance Silicon Devices at the mm-Wave Range and Beyond

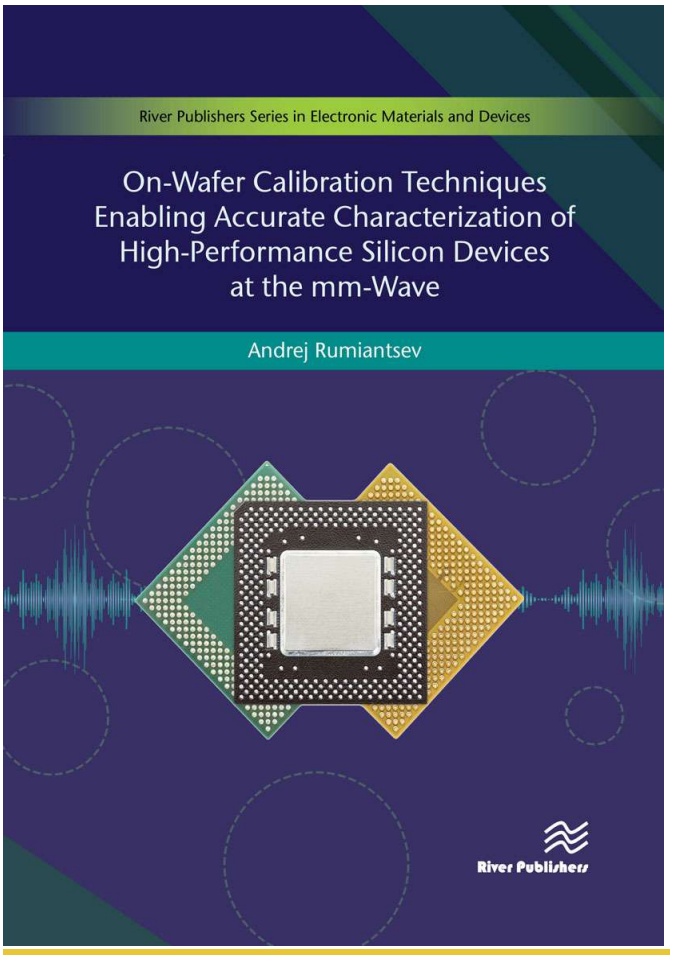
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The increasing demand for more content, services, and security drives the development of high-speed wireless technologies, optical communication, automotive radar, imaging and sensing systems and many other mm-wave and THz applications. S-parameter measurement at mm-wave and sub-mm wave frequencies plays a crucial role in the modern IC design debug. Most importantly, however, is the step of device characterization for development and optimization of device model parameters for new technologies. Accurate characterization of the intrinsic device in its entire operation frequency range becomes extremely important and this task is very challenging.

This book presents solutions for accurate mm-wave characterization of advanced semiconductor devices. It guides through the process of development, implementation and verification of the in-situ calibration methods optimized for high-performance silicon technologies.

Technical topics discussed in the book include:

- Specifics of S-parameter measurements of planar structures
- Complete mathematical solution for lumped-standard based calibration methods, including the transfer Thru-Match-Reflect (TMR) algorithms
- Design guideline and examples for the on-wafer calibration standards realized in both advanced SiGe BiCMOS and RF CMOS processes
- Methods for verification of electrical characteristics of calibration standards and accuracy of the in-situ calibration results
- Comparison of the new technique vs. conventional approaches: the probe-tip calibration and the pad parasitic de-embedding for various device types, geometries and model parameters
- New aspects of the on-wafer RF measurements at mmWave frequency range and calibration assurance.



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