94th Session C: *Special Topics*

Session Chair: Jon Martens

C1 **RF and Quantum Computing (Invited Paper)**

8:00 AM 8:40 AM ***David Root,*** *Keysight Technologies*

Quantum computation promises to transform society as profoundly as any previous technological revolution in human history. Certain information processing problems (e.g., breaking classical encryption protocols based on factoring large integers) that are completely intractable for present day and any conceivable future classical supercomputer, may one day become practical by harnessing the immense power of quantum mechanics through the engineering and control of interacting two-level quantum bits, or qubits. Microwaves play a fundamental role in qubit state initialization, superposition, entanglement, general manipulation for implementing quantum algorithms, and readout in many of the most promising qubit technologies (e.g. superconducting qubits based on Josephson junctions). Moreover, classical microwave-based electronic control systems featuring scalable, multi-channel, synchronous stimulus response measurements with low-latency feedback may be the key to ultimately realizing practical quantum computers. This talk introduces the exciting potential, basic principles, and significant technical challenges of practical quantum computation. The emphasis is on the fundamental role of microwave engineering in the design and physical realization of quantum technologies, and the implementation of quantum algorithms using classical microwave electronic control systems. The emergence of a new "quantum engineering" discipline represents an exciting opportunity for the present and next generation of physical scientists, computer scientists, and microwave engineers.

C2 **Arbitrary wideband Open-loop active load-pull measurement using Unequally Spaced Multi-Tone stimulus**

8:40 AM 9:00 AM ***Vincent Gillet (XLIM)*;*** *Jan Verspecht (Keysight Technologies, Inc.); Jean-Pierre Teyssier (Keysight Technologies); Michel Prigent (XLIM); Raymond Quéré (XLIM)*

This paper presents an implementation of active load-pull measurements using the innovative Unequally Spaced Multi-Tone (USMT) wideband test signal in order to assess the in-band linearity degradation of non-linear microwave power devices. The proposed test bench is suitable for both on-wafer and connectorized devices characterization.
A proof of concept of the arbitrary wide open-loop active load-pull measurement using 8-tones USMT has been detailed, using 90MHz bandwidth with a VSWR of 10:1 on an in-house power amplifier. Load tuning is achieved by reinjecting both the carrier tones and third order intermodulation tones at the output of the amplifier.

C3

Developing Models for a 0.8 mm Coaxial VNA Calibration Kit within the NIST Microwave Uncertainty Framework

9:00 PM 9:20 PM

Jeff Jargon *(NIST)*; Christian Long (NIST); Ari Feldman (NIST); Jon Martens (Anritsu)*

We developed models for a 0.8 mm coaxial vector network analyzer (VNA) calibration kit within the NIST Microwave Uncertainty Framework. First, we created physical models of commercially-available standards and included error mechanisms in each of the standards' constituent parameters that were utilized to propagate uncertainties. Next, we calibrated a network analyzer with this calibration kit and compared measurements and uncertainties of two verification devices with data provided by the manufacturer. We found the measurements agreed to within their respective uncertainties.