IEEE Waveform Generation Measurement and Analysis Technical Committee (TC10)
Meeting Agenda
17 January 2023 / 11:00 AM – 1:00 PM (EDT)

1. Call to Order

2. Introductions and Roll Call

3. Approval of the Agenda

4. Approval of the minutes from the previous meeting

5. TC10 business
    a. eTools – questions, comments, concerns
    b. Quarterly meetings – notifications, invitations
        i. Upcoming: 18 April 2023
    c. New standards

6. Working Groups Updates
    a. Revision of IEEE Std 181, IEEE Standard for Transitions, Pulses, and Related Waveforms
        i. Lead: Nick Paulter
    b. Revision of IEEE Std 1241, IEEE Standard for Terminology and Test Methods for Analog-to-Digital Converters
        i. Lead: Nick Paulter
    c. Revision of IEEE Std 1658, IEEE Standard for Terminology and Test Methods of Digital-to-Analog Converter Devices
        i. Lead: Luca DeVito
    d. Revision of IEEE Std 1696, IEEE Standard for Terminology and Test Methods for Circuit Probes
        i. Lead: John Jendzurski

7. Guest presentation
    a. Allan Belcher (see next page)

8. Adjourn

IEEE SA STANDARDS ASSOCIATION

Information on guest presentation

Title of presentation:

Measuring wide band nonlinearity: Beyond the limits of conventional test methods

Allan Belcher
Signal Conversion Ltd

Abstract: This presentation outlines the alternative effective number of bits (ENOB) method given in IEEE Transactions on Instrumentation and Measurement "ADC Standard IEC 60748-4-3: Precision Measurement of Alternative ENOB Without a Sine Wave" https://xplqa30.ieee.org/document/7166328. The method is aimed at measuring wide band amplitude nonlinearity in both analog-to-digital and digital-to-analog converters (ADCs and DACs) without the need for high linearity DACs.
Measuring beyond the state-of-the-art ADCs would normally require a near-perfect DAC to generate the test signal. A Josephson junction is a quantum-based device that, in principle, should enable a prefect DAC to be made and also a perfect ADC. Such quantum based or Josephson Arbitrary Waveform Synthesiser (JAWS) and voltmeters or digitisers are available commercially but are used primarily in national standards laboratories. The accepted way to measure these digitisers is with a sine wave generated by a JAWS on the assumption that the sine wave has no amplitude nonlinearity, only quantising error. When a conventional ADC is used to measure the output, it is impossible to verify that the DAC is perfect. In order to address that issue, experimental quantum-based ADCs have been produced. Unfortunately, the combination still shows harmonic distortion with a sine wave. This presentation shows how the alternative ENOB method can be used to investigate this issue with the example of it in two EU funded collaborative projects QuADC and True8digit DVM.

Presenter biography: Allan Belcher began his career in 1969 at the engineering research department of the British Broadcasting Corporation (BBC) where he became a senior research engineer. His main research area was audio and video analog-to-digital converter (ADC) and digital-to-analog converter (DAC) design test and measurement. While there, he gained a PhD at University of Surrey for the origination of a pseudo-random-bit-stream-generator (PRBS) based method of measuring audio nonlinearity. In 1978, he became a senior medical physicist at the Velindre Cancer research centre and was responsible for introducing microcomputer-based radiotheraphy treatment monitoring of patients and, in collaboration with the Tenovus research institute, for automating cell electrophoresis measurements that provided early detection of cancer. He joined Swansea University in 1980 as an assistant professor and obtained research funding from both government and industry to pursue the work he began at the BBC. Patents were generated from this work and, in 1985, Allan formed a company, Signal Conversion Ltd (SCL) to exploit these patents, which were licensed to Burr Brown. He left Swansea University in 1998 to work full time with SCL on commercially confidential and classified projects that included being a visiting full professor at the University of California, Los Angeles (UCLA) and working on national and international standards committees related to ADCs and DACs. In 2005, he returned to academia as a part-time full professor of conversion technology at Cardiff University. The research grants he obtained enabled his patented ADC and DAC circuit techniques and measurement methods to be applied to characterising and linearising microelectromechanical system (MEMS) transducers; applying characterising and linearising methods in RF and microwave communication systems, and applying the direct interpolation (DI) method to achieve very high spurious free dynamic range in ultra-wideband demonstrators. In 2016 he left Cardiff University to pursue research in the area of quantum metrology. He now undertakes collaborative research through being a partner in EU funded EuraMET projects.