IEEE Waveform Generation Measurement and Analysis Technical Committee (TC10)
Meeting Agenda
18 July 2023 / 11:00 AM – 1:00 PM (UTC-4)

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. IEEE TC10 history – Bill Boyer
    c. Quarterly meetings – notifications, invitations
        i. Upcoming: 18 July 2023
    d. New standards
    e. Other business

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, Measuring amplitude nonlinearity in beyond the state-of-the-art digitisers : part 2 (see next page)

8. Adjourn

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Information on guest presentation

Measuring amplitude nonlinearity in beyond the state-of-the-art digitisers : part 2

Allan Belcher
Signal Conversion Ltd

Abstract: The author's research into a double comb filter method for measuring amplitude non linearity began at the BBC Engineering Research Department and continued later at Universities. More recent research demonstrated that the method could be applied to characterising analogue to digital and digital to analogue converters and making measurements of analogue transducers with a precision beyond that possible by conventional methods.

In principle it offers unlimited precision in measuring both in-band and out of band non-linearity. Coefficient values of non-linear transfer functions can be determined using the multi source feature and iterative methods. DFT is not required and because only waveform amplitudes are measured there is a low DSP overhead and minimum power. The multi source version of the test signal makes it insensitive to DAC linearity. The demand from industry for wide band dynamic tests of ADCs and DACs, was addressed by including this method in IEC standard 60748-4-3.

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 (EURAMET) funded collaborative projects QuADC and True8digit DVM.

The EURAMET project "22RPT02 True8DIGIT" started on 5 June with the kick off meeting in Dublin 13-14 June. This presentation to IEEE TC10 will include a report form that meeting.

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.