

Strong Demand For Analog IC Design Online Learning

The 2020 pandemic was the catalyst for the “Analog IC Design” short-courses arranged by Hooman Reyhani (IEEE United Kingdom and Ireland Section) since 2015, to switch from the conventional in-person format at the University of Limerick, Ireland, to a live-virtual platform. These online courses are carefully designed to deliver maximum learning for global participants, from world-class experts, offering many unique features including distributed lectures (held twice-weekly over four weeks), live Q&A, optional homework assignments, lecture playback, course forum, etc.

The phenomenal demand for these state-of-the-art online learning programmes resulted in two sell-out courses being held in 2021 and three more in 2022. The opening course of 2023 marked an important milestone of 1000+ global participants, representing semiconductor tech-giants and leading research organizations, from 6 continents, 35+ countries and 19 time-zones, taking part in these cutting-edge analog IC design courses, held since 2015.

The “[Modern Wireline Transceivers](#)” live-virtual short-course, held in January 2023, welcomed 100 participants, from 5 continents, 21 countries and 17 time-zones, eagerly tuning in to the captivating presentations of Prof. Chan Carusone (University of Toronto & Alphawave Semi). This course explored the critical system-level aspects of tomorrow’s 200 Gbps transceiver challenges where the participants learned all the main building blocks of a wireline transceiver system and the interaction between them, as well as the requirements of various sub-systems, depending on the application. DSP modelling as well as jitter modelling were covered in depth.

Equalization & Baud-Rate Timing Recovery Interaction

- MM-PD detects phase error based on the correlation of neighbouring equalized samples
- It performs best when:
 - $\frac{dh_{\pm 1}}{dt}$ is large
 - $\hat{h}_0 = 0, |k| > 1$

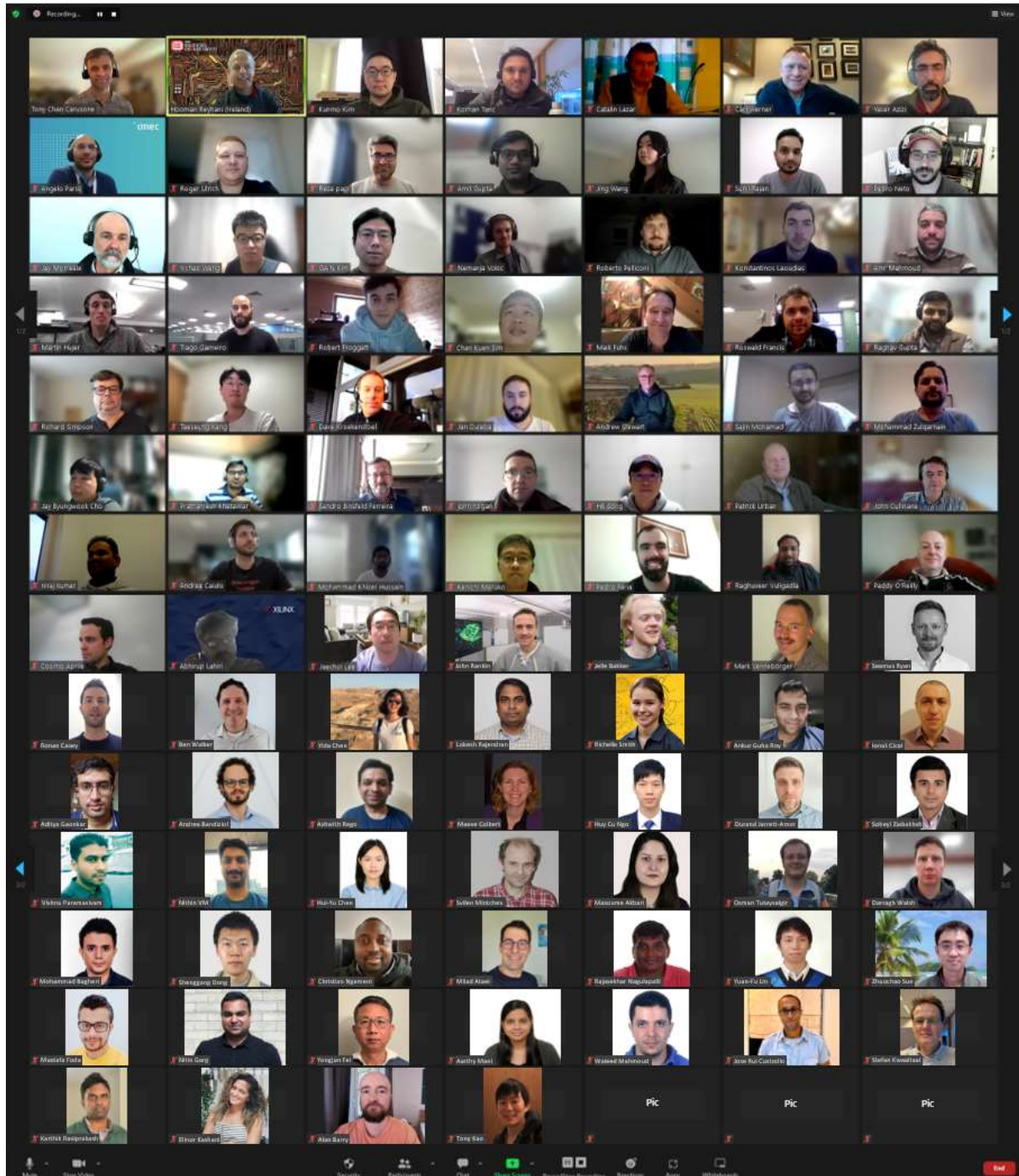
MM-PD gain: $\frac{dh_1}{d\phi} - \frac{dh_{-1}}{d\phi}$

➤ Thus, slightly different criteria apply to the optimization of FFE-t and the main FFE/DFE which seek to minimize all $h_k, k \neq 0$.

- Note, the AFE is implicated in both paths

Prof. Tony Chan Carusone, course presenter, talked about “*Modern Wireline Transceivers*” at an online course hosted by Hooman Reyhani, Ireland.

The main topics included Trends and Applications of SerDes; Modulation and Coding; Channel Modelling; Analog & Digital Equalization; Maximum Likelihood Sequence Detection; Clocking; Optical Communication; and Case Studies. Exciting Python-based homework assignments (optional) included the generation of 2-PAM & 4-PAM waveforms with filtering, coding & decoding with bursts of errors, channel modelling with non-idealities, CTLE circuit modelling, partial response trellises, Rx & Tx clock jitter modelling, optical modulation & RLM.



The lecturer, organizer and many of the participants of the *“Modern Wireline Transceivers”* online course, January 2023.

Prof. Chan Carusone has been a faculty member at the University of Toronto since 2002. He is currently the Chief Technology Officer of Alphawave Semi in Toronto, Canada. He has co-authored the classic textbooks “Analog Integrated Circuit Design” and “Microelectronic Circuits”, as well as several award-winning publications at various IEEE conferences. Dr. Chan Carusone was a Distinguished Lecturer for the IEEE SSCS, 2015-2017, and served on the TPC of the ISSCC, 2015-2021. He has served as Editor-in-Chief of the IEEE TCAS II, Associate Editor for the IEEE JSSC, and is now Editor-in-Chief of the IEEE SSCL. He is a Fellow of the IEEE.

The feedback from the course participants was extremely gratifying. One participant wrote, *“Prof. Chan Carusone has a deep knowledge of this topic with confident command of the presentation”*. Another said, *“The course exceeded my expectations. I learnt a lot in a relatively short time”*. While another commented, *“The infrastructure, organisation, and especially the recordings are a major plus. The course format is perfect and optimized for a global audience”*.

Full access to this course content, as well as our previous courses, may be requested (subject to payment) via [here](#). For more information, [please see here](#).

— Hooman Reyhani