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The World Is Analog—How Do I Obtain the Necessary Knowledge?!

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If we read trade magazines or check the internet, we quickly get the impression that today's world is digital and that analog technology is a thing of the past. Is that the truth?

Not really. Every physical element, be it an audio signal or a temperature, is an analog value; to measure or manipulate an analog value, you need analog technologies. Every fast digital signal transmission has to deal with analog phenomena and only those who understand it can optimize it. Once you realize that software cannot solve every problem, you can acquire the knowledge that is so desperately needed in today's working environment. New technologies such as electric vehicles and renewable energies cannot be controlled without analog knowledge. Despite this, the number of hardware experts in the market is shrinking, which means having knowledge about semiconductor circuit technology opens up outstanding career opportunities for students and new college graduates.

To get started on a path to becoming an expert in analog technology, Analog Devices has developed active learning modules that enable you to gain analog knowledge and experience through prepared lab experiments. The modules can be used within the scope of a university education or independently to provide a better understanding of learned theory. They allow anyone to gain practical experience with electronic circuits anywhere and at any time. Some students may prefer to work alone at night, while others would like to cooperate with fellow students, work together, and discuss results. If an experiment fails, there is nobody watching in amusement and the experiment can be repeated. The modules also help when it is difficult to secure a lab spot, time, or equipment at a university. A benefit of the modules is that multiple students can run experiments in parallel instead of having some just observe.

The learning modules are not PC simulations with prepared results; they are practical lab experiments. They allow you to build circuits, apply input signals, measure analog or digital output signals, and analyze the results on a PC. In addition, they are economical and thus can be purchased on a tight student budget.

Below are the currently available kits from Analog Devices.

ADALP2000

The ADALP2000 is an assortment kit containing various Analog Devices chips and discrete components such as resistors and capacitors. With it, different electronic circuits can be built on the supplied breadboard without the need for soldering.

Figure 1. ADALP2000 analog parts kit.

ADALM1000

This is a learning module for basic experiments. This module is connected via a USB interface and thus offers a programmable voltage supply of 2.5 V or 5 V and up to 200 mA. Different voltage and current waveforms can be sourced via two channels. Voltages of 0 V to 5 V, currents ranging from –200 mA to +200 mA, and waveforms can be sampled at up to 100 kSPS (kilosamples per second). With the associated software, available for Windows, Linux, and Mac OS X systems, you adjust parameters and display the measurement results on your computer using an oscilloscope function. Numerous experiments that can be conducted with the ADALM1000 are described in detail under the section "Circuit I and II Lab Activities" on the Analog Devices website.

Figure 2. ADALM1000 active learning module.

ADALM2000

This is a learning module for advanced experiments. ADALM2000 can do everything the ADALM1000 series module can and more. With signal measurement up to 25 MHz and signal generation up to 30 MHz, the ADALM2000 is about 1000 times faster. The two power supplies can be adjusted in the ranges of 0 V to +5 V and –5 V to 0 V. The software is able to display a 2-channel oscilloscope and a 16-channel digital logic analyzer as well as a corresponding voltmeter. Networks, spectra, and digital buses can be analyzed. The corresponding lab experiments can be found under "Electronics I and II Lab Activities." With a few small adaptations, the experiments designed for the ADALM1000 kit can also be conducted with this kit.

Figure 3. ADALM2000 active learning module.

ADALM-Pluto

The ADALM-Pluto kit is a high frequency kit that enables you to gain in-depth knowledge about software-defined radio (SDR), that is, the setting of frequency bands and properties via software, for high frequency and wireless communication. The kit features a frequency range extending from 325 MHz to 3.8 GHz as well as a built-in transmit and receive channel. Users can familiarize themselves with the system with support from the book *Software-Defined Radio for Engineers,* which can be downloaded from *analog.com* for free. The book also describes a few experiments that can be done with the ADALM-Pluto kit.

Figure 4. ADALM-Pluto active learning module.

More information on the kits can be found on *analog.com* under "Education" or by searching for "active learning modules." The kits can be ordered directly from Analog Devices or one of our distributors. Specific questions regarding the kits are answered in Analog Devices' EngineerZone® in the Virtual Classroom for ADI University Program section.

The world is, and will remain, analog and needs engineers with strong analog knowledge. So, get started!

About the Author

Uwe Bröckelmann joined Analog Devices in 2003. From 2004 until 2012 he led the Field Applications Engineering (FAE) Team of Analog Devices in Central Europe, and from 2008 to 2015 the Automotive FAE Team across all of Europe. Since 2015, he has led an interdisciplinary team of applications engineers and oversees the technical development of all Analog Devices FAEs in EMEA.

He studied automation at the University Kaiserslautern and received the Diplom-Ingenieur degree in 1995. He started his professional career as a hardware design engineer at Siemens AG in Fuerth, then spent 5 years as FAE at Maxim GmbH in Planegg before transitioning to Analog Devices. He can be reached at *uwe.brockelmann@analog.com*.

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TA21567-8/19