



# Innovation Through Engineering Education in Armenia

To meet demand for high-quality graduates, the Armenian National Engineering Laboratories (ANEL) has partnered with NI to empower students with a hands-on learning experience using advanced technology to solve engineering problems and transform these solutions from research to impact. Founded in 2013, ANEL is a world-class center of excellence driving innovation in the Armenian high-tech industry, increasing international competitiveness, and building a workforce of industry-ready graduates.

## Challenge

National Polytechnic University of Armenia (NPUA) aimed to increase local and global demand for Armenian engineering talent with the goal of helping Armenia become a global exporter of engineering technologies, products, and services.

## Solution

Through a public-private partnership, NPUA converted its teaching laboratories into fully equipped, state-of-the-art learning spaces built on advanced curricula and teaching materials. Through a strong focus on hands-on, project-based learning and driving student employability as a key outcome, the university now produces specialists and graduates with the engineering knowledge to drive innovation. ANEL is a key engineering center of excellence in Armenia that services multiple faculties in teaching and research.

## Partnering for Impact

Armenia, a relatively small country with a population of less than 3 million, is home to NPUA, a nationally recognized leader in science and technology. The city of Yerevan is not only a center for education but also a regional manufacturing hub. As a result of an innovative public-private partnership, NPUA is now considered a powerful producer of high-quality engineering talent internationally.

Launched in 2013, ANEL began preparing world-class engineering talent to solve critical engineering challenges and catalyze the local and regional innovation ecosystem. ANEL has partnered with NPUA, the government of the Republic of Armenia, the United States Agency for International Development (USAID), Enterprise Incubator Foundation (EIF), and global industrial partner NI to meet Armenia's growing demand for qualified specialists trained in cutting-edge technologies. A key metric of success has been to infuse increased innovation in local high-tech businesses and drive the international competitiveness of Armenia. ANEL's upgraded lab and research facilities help strengthen educational capacity with a growing student population and enhance Armenia's engineering sector to achieve competitive standards.

ANEL emphasizes building student competency with a combination of technical training and research support to prepare engineers to make an impact across a wide range of industries. The University of Armenia invested in a singular center of excellence that would service all departments and become a focal point for multidisciplinary innovation. Located on the NPUA central campus across from the engineering



### Customer Profile

The National Polytechnic University of Armenia (NPUA) was founded in 1933 and is a technical university based in Yerevan, Armenia with branch campuses in Gyumri, Vanadzor, and Kapan. With more than 8,000 students and 750 faculty, NPUA is nationally recognized and offers the region's top educational and research programs in science, technology, and engineering.

school, ANEL is an impressive physical space that spans four floors and over 1,600 square feet of laboratories. These laboratories are fully equipped with the latest hardware and software based on NI technology to support a project-based learning experience. With 24 lab managers, ANEL's hands-on approach is integrated into the curriculum of 20 faculties.

Each semester, more than 1,500 students pass through ANEL's educational labs and gain exposure to engineering experiences including workshop management, introduction to engineering projects, and engineering practicum. Exceeding its goals on average by 30 percent, ANEL's impact for students, educators, and researchers includes:

- 9,000+ students trained
- 34 educational and research lab specializations established
- 150+ trainers trained
- 120+ laboratory assistants trained
- 140 engineering curricula updated
- 68 research projects implemented
- 10 startups incubated
- 38 engineering companies/teams assisted

This visionary building has made it possible for NPUA to have a state-of-the-art laboratory that differentiates itself from other regional institutions with a strong curriculum and labs integration, focus on hands-on learning for multiple engineering faculties, and space for modern learning outcomes to merge with research activities. By investing in a multidisciplinary laboratory, ANEL optimized cost with one lab that could take advantage of spaces that can drive collaboration across the university, and even incubate talent toward commercial outcomes.

## A Space for Innovation and Research

ANEL features 30 specialized and universal educational and research laboratories and offers teaching labs for seven major university departments including:

- Cybernetics
- Radio Engineering and Communication Systems
- Power Energy
- Electrical Engineering
- Transport Applications
- Mechanical and Machine Building Engineering
- Computer Science



In the Measurements Lab, students learn measurement fundamentals, including the measurement of electrical and physical quantities.

NI technology drives learning outcomes and innovation on every floor, but the first floor trains high-quality, industry-ready developers who understand LabVIEW. The teaching labs on the first three floors are equipped with NI tools and other technologies from electronics to control systems to mechanical engineering laboratories. The fourth floor offers the latest research tools, including PXI systems and CompactRIO, for faculty, researchers, and entrepreneurs to power high-tech businesses and solve global engineering challenges. The research facilities on the fourth floor include five research laboratories that specialize in:

- embedded systems
- circuit techniques
- data collection and measurement
- telecommunication
- precision measurement

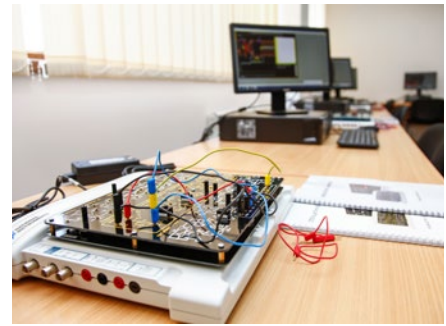
For example, the telecommunications laboratory uses the NI Massive MIMO software architecture. Researchers have built a Massive MIMO testbed to rapidly prototype large-scale antenna systems using the award-winning LabVIEW system design software and state-of-the-art USRP RIO software defined radios (SDRs). With a simplified design flow for creating FPGA-based logic and streamlined deployment for high-performance processing, researchers in this field can meet the demands of prototyping these highly complex systems with a unified hardware and software design flow.

ANEL has already facilitated innovative research outcomes including:

- **Channel Estimation for MIMO-SDR Communication Systems**—Researchers at ANEL developed a new method of multiple input, multiple output (MIMO) channel estimation for pseudo phase-coherent MIMO communication systems that significantly increase the noise immunity of MIMO communication systems based on SDR devices.
- **Ultra-Wideband Radar Prototype**—This new platform aims to decrease development time and cost using ultra-wideband radar, which increases information possibilities more than conventional radar.

## Achieving Sustainable Learning Outcomes

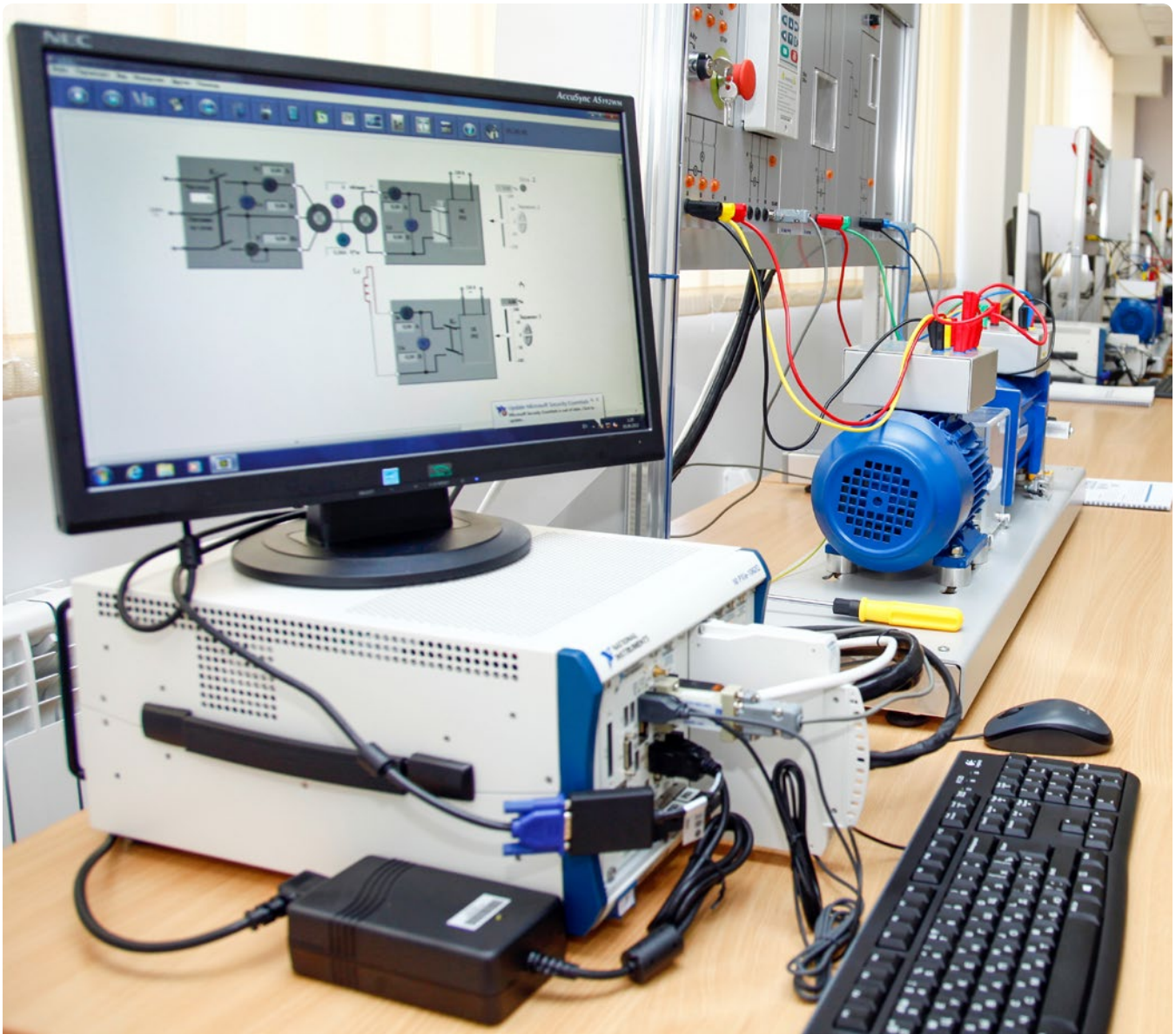
To strengthen local, regional, and global entrepreneurial ecosystems, ANEL has successfully delivered world-class laboratories and technical support to high-tech businesses and startups. In addition to NI, ANEL



Students use the Power Electronics Lab to expand their practical skills by working with real circuits.



In this world-class RF Systems Lab, students design communication systems.



### NI Products Used:

- LabVIEW
- PCI/PXI/USB DAQ
- NI ELVIS II
- PXI
- CompactRIO
- Speedy-33 DSP Starter Kit (DSK)

### Industries:

- Industrial Electronics
- Semiconductor Test
- Power Energy
- Communication Systems
- IIoT
- Automotive
- Automated Test System
- Education

### Application Areas:

- Teaching Circuits and Electronics
- Teaching Measurement and Instrumentation
- Teaching Controls and Mechatronics
- Teaching RF and Wireless Communications
- Academic Research

cooperates with numerous industry leaders and research institutions across Armenia and the region to quickly and inexpensively solve science and technology challenges.

To sustain success, ANEL generates revenue through certificate courses, advanced training courses, consultancy/mentoring/coaching, engineering services, and joint research projects with the private sector as well as universities and research institutions.

## Author Information

Amalya Mkhitarian, [amalya.mkhitarian@ni.com](mailto:amalya.mkhitarian@ni.com)

Joanna Iacovelli, [joanna.iacovelli@ni.com](mailto:joanna.iacovelli@ni.com)



The ANEL team attended DigiTec Expo 2016, the largest technological exhibition in the region with over 60,000 visitors including international leaders, educators, startups, and subject matter experts.

## Discover the Possibilities With National Instruments

NI equips engineers and scientists with tools that accelerate productivity, innovation, and discovery. A graphical system design approach leverages productive software and reconfigurable hardware platforms, along with a vast community of IP and applications, to simplify system development and help engineers and scientists arrive at solutions faster

Learn more at [ni.com/academics](http://ni.com/academics)  
Browse more teaching resources at [ni.com/teach](http://ni.com/teach)