

Rethinking Engineering Curricula to Meet Industry Demand

The role of higher education is currently under review in the U.S. According to the Washington Post¹, a growing number of high school students see college as the means to a job — period. It cites a Harris Poll finding that shows the biggest enrollment motivator among 14- to 23-year-olds is financial security. Rather than pursuing individual passions or interests, students are selecting majors based on available employment.

At the same time, colleges and universities are struggling to graduate job-ready students. Keeping the curricula relevant is especially difficult when the reality is 85% of the jobs today's students will hold in 2030² haven't been created yet.

Preparing students for their futures is particularly challenging for engineering programs. According to the Swanson Advisory Board (SAB) at Cornell University, the typical engineering curriculum is not being updated fast enough to support the needs of industry in the 21st century. Digging deeper, a recent CIMdata report³ found:

“Students are not being provided with an understanding of the key role that modeling and simulation provide, in the context of current and future digital engineering processes that rely on the use of sophisticated models throughout the entire product life cycle.”

To explore the academic–industry disconnect, we've focused our discussion on two (related) electrical engineering disciplines: antenna and RF component/systems design. Through interviews with Stavros Georgakopoulos, professor and director of Florida International University's (FIU's) Transforming Antennas Center and RFCOM Lab, and Larcen Reid, engineering manager at L3Harris Technologies, we investigate what universities are and aren't doing to ease the shortage of trained engineers.

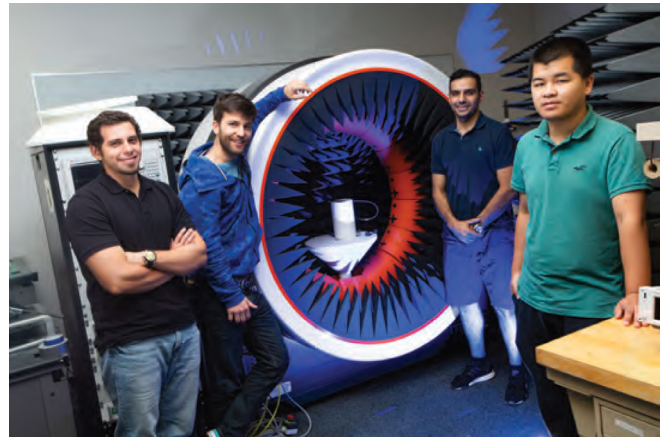


Image courtesy of Florida International University.

/ Engineers in short supply

That a shortage exists is the first of many points on which Georgakopoulos and Reid agree.

Months before the merger with L3, Reid began a search for 1,000 engineers to work in Harris' avionics segment. The hiring spike was in response to industry's amplified need for signal integrity analysis in high-speed communication applications, and for size, weight and power (SWaP) reduction in phase array/antenna designs.

“Where we're located [near Orlando, Florida],” says Reid, “there are numerous companies competing for the same, very limited supply of talent. RF and antenna design are still niche fields, which makes filling our open positions a real challenge.”

Georgakopoulos, who arrived at FIU after years in the field, is acutely aware of the shortage. In working with industry advisory committees, he hears a familiar lament: Why aren't more graduates equipped with the skills — specifically, electromagnetics (EM) simulation skills — we so desperately need?

“It's really a great time to be an RF/antenna engineer,” says Georgakopoulos. “High-frequency applications are being developed in healthcare, aerospace and defense, consumer electronics ... in almost every industry around the globe. Our job as educators is to ensure our graduates have the skills they need to be productive on Day One of their first job.”

/ A case for simulation

For Georgakopoulos, introducing simulation into the undergraduate electrical engineering curriculum was a “no-brainer.” In his first job out of graduate school, he was responsible for integrating EM simulation, specifically Ansys HFSS, into his employer’s RF design workflow. After hands-on HFSS training at Ansys headquarters, he added new-employee training to his industry role. Later, as an assistant professor at FIU, he continued to employ HFSS in his research. At that time, Georgakopoulos was working with only the handful of software licenses he and his research team required.

With the evolution of the Ansys Academic Program⁴, Georgakopoulos, in 2003, procured the number of simulation licenses he needed to bring HFSS into the classroom. The innovative program offers licenses to academia at drastically reduced prices.

“I tell my students all the time to pay attention,” says Georgakopoulos. “You have the opportunity to learn what your would-be employers are using — the industry-standard software for EM analysis and verification. And, it’s not a “lite” version: It has all the bells and whistles, all the functionality. And, that’s not all: You also have access to computational fluid dynamics and mechanical simulation as part of the academic package.”

Georgakopoulos says simulation plays another, equally important role in preparing job-ready graduates. Integrating it into the classroom promotes greater understanding of the very difficult-to-learn-and-teach math- and physics-intensive subject matter.

“Adding simulation adds excitement,” says Georgakopoulos. “Students can build things from scratch and see them come alive. For the first time, for example, they can visualize how electromagnetic waves radiate.

It’s a perfect teaching tool for my students, who were raised on video games and are used to touching a screen and 1-2-3 making something happen.”

The word has spread about Georgakopoulos’ simulation-spiced classes. Initially, enrollment averaged 10 students per semester. After Georgakopoulos added HFSS to the curriculum, class sizes swelled to capacity. There is currently a waiting list for students wishing to study antennas.

By combining simulation with theory, Georgakopoulos knows his students are better prepared for error-intolerant job responsibilities. Outside of school, design budgets must be strictly adhered to and antennas must perform as expected. “I tell my students that the software is both very powerful ... and dangerous. They need to learn the impact of every option they click and understand how to interpret the answers they get to their what-if questions. When they do this, they gain the confidence they need to excel in the workplace.”

/ Simulation adoption in academia

In his role at L3Harris, Reid collaborates with academia to develop a talent pipeline. “Professors and deans are the gatekeepers of curricula. Those with HFSS experience are naturally more open to the idea of integrating simulation into the course content. There is also some initial hesitancy, as you would expect when dealing with any kind of change,” says Reid. “However, anyone I’ve ever introduced to the software has been eager to learn more and work with it.”

Georgakopoulos has witnessed similar reluctance. “It takes a willingness to put in the time to refresh the syllabus and develop the teaching resources if you want to prepare students for the future,” he says.

CIMdata found that a common misperception exists among professors. There’s the belief that updating a curriculum—adding something new — requires subtracting something else. Many educators worry that simulation will cut into course time devoted to important theoretical principles and concepts.

“I didn’t replace or eliminate any content,” says Georgakopoulos. “I’ve incorporated simulation into my lectures and added video tutorials to the curriculum to very effectively reinforce in-class learning.” Students can follow step-by-step setups and solutions at home and bring their questions to class, or they can review the videos as a follow-up to classroom demonstrations. After each tutorial, students are required to complete an assignment for added reinforcement. “The tutorials make my lectures more powerful,” he adds. “I can talk about a particular type of antenna and my students can use the tutorials, at home, to design one in 3D and investigate its performance.”

FIU has recently hired a number of newly graduated engineering faculty. Like other colleges and universities, it’s experiencing a wave of retirements and must backfill vacated professorships. The good news is that fresh-from-graduate-school Ph.D.s know simulation and can craft their curricula to include it.

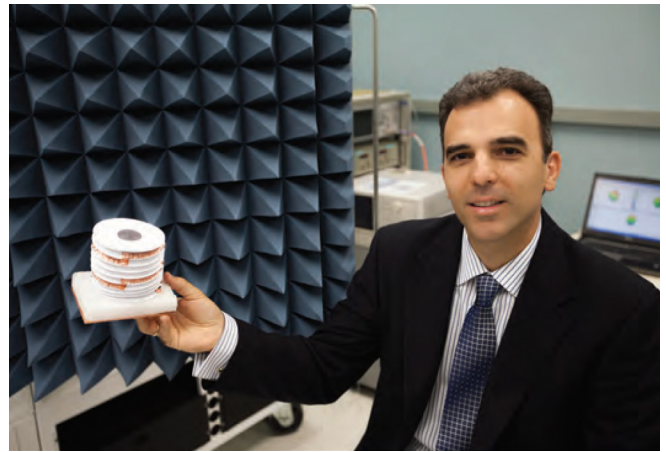


Image courtesy of Florida International University.

/ Simulation as a differentiator

HFSS training is critical for antenna engineers and has recently become a must-have for RF engineers. “When I see HFSS on a resume, it immediately gets my attention,” says Reid. “New employees who come in with some familiarity with the software often come up to speed and contribute more quickly. Time to productivity is key in our industry where speed and on-time delivery is everything.”

At L3Harris, incoming engineers with some HFSS experience (versus “power users”) are more easily mentored by experienced engineers. “Having some background, be it a couple of projects, is critical for communication and collaboration,” says Reid. “It offers both the new and seasoned engineer a common language with which to work together. HFSS training provides the new engineer with the terminology to ask good questions, and the foundation to understand what he or she must learn.”

Employer-sponsored training is not only time-consuming and costly, but it’s often less robust. “At FIU, we have time,” says Georgakopoulos. “We have a whole semester, not two or three days — we can go in-depth, give our students a solid foundation for leveraging all the software has to offer.”

The real value of learning HFSS on campus, either in class or online, becomes readily apparent as seniors approach graduation. Some might say that the proof is in the proverbial pudding. “Without fail, every year, from every class, students come back to tell me, ‘Professor you were right. Having HFSS on my resume, got me noticed,’” says Georgakopoulos. “When you are competing with so many other students for a job, and you’re randomly throwing resumes over a wall, it’s hard to stand out. My students, meanwhile, are getting moved along to phone interviews almost immediately. All get job offers — some get two or three.”

Graduating job-ready, highly skilled students makes higher-learning institutions more attractive too. They are able to recruit higher caliber students and faculty, and supply L3Harris and others with the talent they need to power innovation in the 21st century — and beyond.

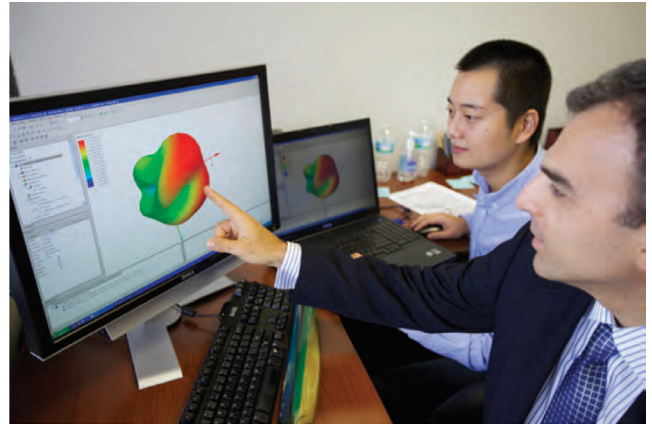


Image courtesy of Florida International University.

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