Meet Keysight’s Modeling Software R&D Engineer: Q&A with Lina Cao

Keysight PathWave ADS and GoldenGate are known for superior accuracy, performance, and integration among the electrical engineering community. We talked with Lina Cao, a senior software R&D engineer from Keysight EDA, to discover more about the value delivered to Keysight’s customers through modeling software development.

Q: What inspired you to take a technology career path?

Lina: I chose to work in technology because I enjoyed the challenge of finding creative solutions to complex problems. I've always enjoyed mathematics and physics. And besides, I love sci-fi movies! So that’s why I’m into technology.

I’m amazed at how technology can change people’s lives too. When I was young, about 10 years old, we only had wired phones which were very expensive to install in the home. But by the time I went to college, six to eight years later, we’d almost eliminated wired phones in favor of cell phones. It’s become much cheaper to own a cell phone and changed our way of communication.

Q: What’s your favorite sci-fi movie?

Lina: It’s from when I was little, I watched Contact, with Jodie Foster. In the movie her character is very smart, but life is unfortunate for her, losing her father when she was young. And then at the end of the movie, she saw her father in some mysterious way. She pursued her way even when nobody believed her, but she stuck to her journey. I was intrigued by the scene when she was alone, lying down on the big antenna in Puerto Rico (Arecibo Observatory).

Q: So when you went to college you became an electrical engineer. You then specialized in RF and microwave?

Lina: Yes, when I was in undergraduate study, we didn’t have a special focus. At my university, the course was a part of the electrical engineering department, but our school focused on communication technology, wireless technology, and communication theory.
Q: What did you do after undergraduate study?

Lina: I went to that university’s master's program, and I focused on microwave engineering. And then I came to the United States for my PhD, with the focus on semiconductors.

Q: What were you researching for your PhD program? What problem were you solving?

Lina: When I was doing my PhD research, I chose to study gallium nitride (GaN) devices. Engineers use GaN devices in RF power electronics and high-speed switching. I was working on accurate device modeling, fabrication, and characterization for microwave and millimeter wave applications. It was a weird device called the IMPATT (IMPact ionization Avalanche Transit-Time) diode, for high power, high frequency signal generation. These were interesting because with GaN the breakdown voltage is really high, the current at breakdown is also high, so the power output is really, really high. You can use that to generate high power at a very high frequency. So that's the goal. The figure below shows the schematic cross section of a GaN IMPATT diode processed with ion implant isolation.
Q: How did you first become familiar with Keysight? When did you start using Keysight products?

Lina: I first used Keysight PathWave ADS and a Keysight VNA when I was a senior in my undergraduate years. At the end of my undergraduate year, we needed to design something to graduate. For that semester, we only needed to do that one thing, and I used ADS to design the receiver part of a transceiver. I used the VNA to test the low noise amplifier for my receiver.

Q: What is your current role at Keysight?

Lina: I am a Software Engineer. After I received my PhD, I was looking at many job options, and I went to a SWE (Society of Women in Engineering) conference. At the conference I met a lot of people, but Keysight particularly showed great support to and welcomed women engineers. From those contacts I had the chance to interview at Keysight and become an employee.

Q: How long have you been working at Keysight? What has been your most exciting work challenge or project?

Lina: I joined Keysight in May 2020. The first year I worked for the DDR squad, and the next two years for the RF and Microwave squad, which I am still a member. I think the most exciting project I’ve worked on is the causality check feature for the S parameter toolkit in ADS. That feature used generalized dispersion relations to check causality in the frequency domain based on a research paper. The method is supposed to be robust and reliable. What made it exciting for me was taking research paper theory and implementing it, integrated a new method into the S parameter toolkit.

Then this feature was later employed by another Keysight team, the EM Pro team. And they integrated it into their product. We also converted the causality check library into a package and distributed it across different teams, so now anyone in Keysight can use it. That’s why I think it’s the most exciting because a lot of people can benefit from it.

Q: What do you work on as a software engineer at Keysight currently?

Lina: I work on implementing Compact Device Models from the Compact Model Coalition (CMC) for our RF and Microwave squad. I collaborate with the team, directors, architects, and other engineers. I also represent Keysight at the quarterly CMC meetings to discuss progress on all device models and projects. That’s why my current role fits my background, because when I was doing my PhD, I studied semiconductor device physics and design.
Q: Tell us more about Compact Device Models.

Lina: A Compact Device Model is a model representing the physical semiconductor device. It’s not exactly an algorithm, but it’s very complicated, and represents the behavior of the physical device. Keysight is a subscriber to the CMC who provides the models. Then we integrate those models into ADS in such a way that customers can easily use them.

Q: What is involved with integrating Compact Device Models into ADS and GoldenGate? What kind of customers then rely on those models?

Lina: I update the device model and simulator front-end parsers, so ADS and GoldenGate use those models correctly. There are also changes made to the device model which make simulations much faster than with the standard Verilog-A model. We have our own internal device compiler, so those changes need to comply with the rules of that compiler.

Q: Why is that critical to customer success?

Lina: In addition to better performance, we do the simulator integration work so customers won’t have to purchase, integrate, and debug the models themselves. Some customers have expressed directly that this is a huge benefit to them, saving money and also time by using built-in models.

Q: What is your typical work schedule?

Lina: Every Monday, Wednesday, and Friday, we have a scrum meeting for about half an hour. After the meeting, we report our project progress and if we’ve encountered problems or speed up and see if other teammates can help or have any alternative ideas.
Q: When you came to Keysight, was that the first time you had experienced agile development methods and processes?

Lina: Every Sprint is about 3 weeks. At the beginning of each week we usually plan our goals in tickets, look at the end of the last sprint and so-on. We’re pretty good at finishing our tasks and goals in two weeks, with one week for QA to finish testing. Sometimes we get a large task, and we need to split it across multiple sprints. Over time with a good scrum master and manager, it becomes easier to divide projects more accurately to control them appropriately.

When I was new, I didn’t have much experience with scrum. This is the first job I had with proper scrum tools and processes which have helped me do it right. There are some difficulties I didn’t know before starting on this job, so at the beginning it was hard to give accurate estimates. When I got more familiar with the job, I became much better at estimating effort and time.

Q: How do you see your software engineering team and the work you do for your department fitting into the bigger Keysight picture?

Lina: Software is a key part of the comprehensive solutions Keysight offers. Customers can use our software to design and model, then use our hardware to verify their solutions. I would say software complements the hardware offerings. It enables customers to analyze and interpret the data more efficiently and accurately.

Q: What EDA trends do you see that present opportunities for Keysight to expand and do something new and powerful?

Lina: Our customers use many different EDA tools and platforms. If we can address this opportunity by integrating with some third-party tools and platforms, then we can improve efficiency for them. I was amazed after our recent acquisition of Cliosoft. It’s like Git for EDA software with version control, visual comparison, and data management. It’s a brilliant idea. People need it. And it fits with one of the EDA trends that I see, which is cloud-based solutions. Cloud-based solutions offer customers more flexibility and stability in their design workflows.
Q: If you had any wishes for transforming how Keysight develops and deploys software, what would they be?

Lina: I would say more cross-team collaboration and data management. Better cross-team data management can improve our efficiency, so we are not reinventing wheels. Along the same line, if we have better internal documentation we could search inside our company and know what’s available for reuse. Another wish would be that we have some automation scripts for simplifying some parts of our workflow. For example, there are common changes we make to every model we implement.

Q: On the personal side, what do you like to do for recreation or hobbies?

Lina: For hobbies, I enjoy playing table tennis and basketball during my spare time. I think for table tennis, every Chinese person can play, right?

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