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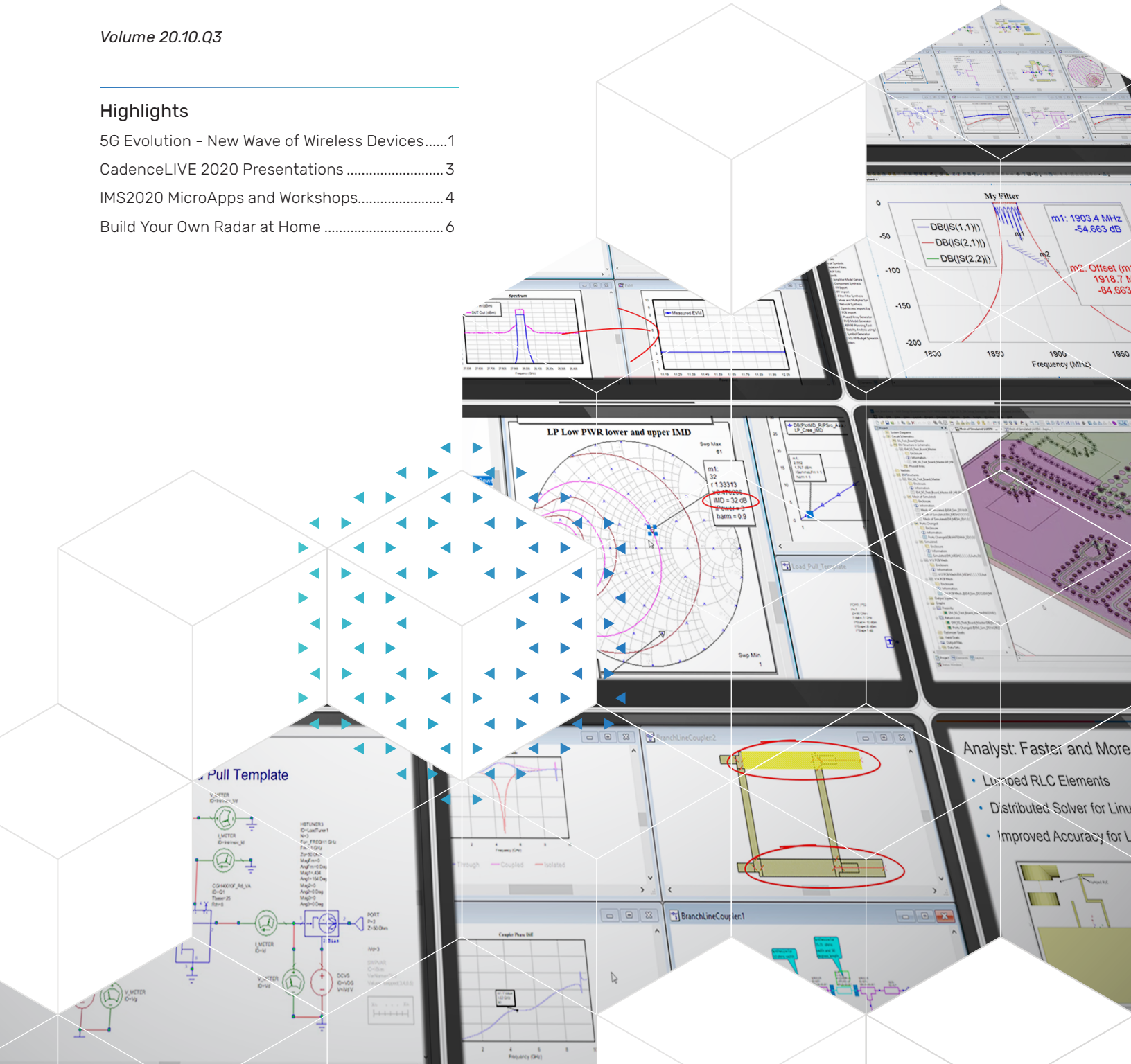
CADENCE AWR DESIGN **MAGAZINE**

A quarterly publication highlighting Cadence® AWR® RF/microwave design software for product development through white papers, application notes, and success stories.

Volume 20.10.Q3

Highlights



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FEATURE **STORY**

5G Evolution Supports a New Wave of Wireless Devices

The release of each new generation of wireless technology every decade or so has enabled mobile communication to progress considerably since the first portable phones appeared in the 1980s. Technical advances have created new services and business opportunities, driving what's being referred to as the third wave of communications. The evolution made possible through 5G and future 6G technology will support even more new services for industry and society, well into the 2030s and beyond.

5G represents the first step toward this next wave of services with expanded connectivity and a significant upgrade in multimedia capabilities combined with artificial intelligence (AI), machine learning (ML), and the internet of things(IoT). 5G will be the first generation of mobile communications to utilize millimeter-wave (mmWave) band frequencies, supporting bandwidths of several hundred megahertz and actualizing ultra-high-speed wireless data communications of many gigabits per second. This article examines the expansion of 5G/6G wireless communications to new areas of service that will drive another industrial wave and offer greater business value for industry and society.

The Third Wave of Wireless Communications

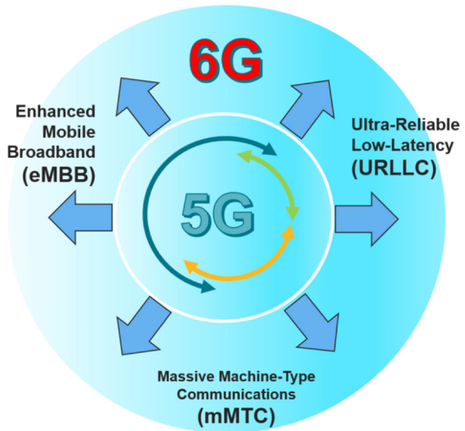
5G and future systems will close the gap between the physical and cyber worlds. Today, mobile consumers use wireless connectivity to access the web from almost any location. In the future, high-speed coverage will be more widespread and faster, with greater emphasis on uplinking information from real-world events, either human and/or IoT, to the internet.

Once this information is in the cloud, AI could reproduce the real world in cyberspace and emulate it beyond physical, economical, and time constraints, so that "future prediction" and "new knowledge" can be discovered and shared. The role of wireless communications in this cyber-physical fusion is assumed to include high-capacity and low-latency transmission of real-world images and sensing information, and feedback to the real world through high-reliability and low-latency control signaling.

Radio communications in this cyber-physical fusion scenario correspond to the role of the nervous system transmitting information between the brain and the body. Communications convert real-world events to the cyber world through enhanced uplink capabilities and provide feedback information to humans and devices through low-latency downlink functionality.

6G Performance Goals

6G will implement many different technologies to achieve its performance goals. Among them will be new topologies of overlapping cells with distributed networks of beamforming antenna controlled by AI and ML to dynamically select optimum transmission paths. The next wave of communications focuses on three areas of service, shown in the figure.



Conclusion

A key goal of 5G has been to expand the reach and value of wireless technology beyond the individual mobile subscriber in support of mMTC and URLLC. Expanding connectivity to include network-to-smart device communications, combined with AI and IoT, will usher in a new industrial wave and offer greater business value for both industry and society.

AWR Presentations at CadenceLIVE 2020

For the last 15 years, CDNLive Silicon Valley has brought together technology users, developers, and industry experts to connect, share ideas and best practices, and inspire design creativity. This year Cadence hosted an exciting digital experience with a new name—CadenceLIVE Americas. AWR software presentations from the event are now available on demand and include:

- Cadence AWR Design Environment for RF/Microwave Designers
  Dr. John Dunn, Cadence
- 5G NR: RF to mmWave Front-End Component Design
  David Vye, Cadence
- 5G NR: EM Analysis of Phased Array Antenna Design
  Dr. John Dunn, Cadence
- Connected Car: From Sensors to Infotainment Systems
  Dr. John Dunn, Cadence
- Connected Car: Radar Technology for Advanced Driver Assistance Systems (ADAS)
  David Vye, Cadence
- From Bits to Waves - Building a Modern Digital Radio
  Dr. David Ricketts, North Carolina State University

Register to view the video presentations at https://onlinexperiences.com/Launch/Event.htm?ShowKey=99241.

Virtual IMS2020 MicroApps and Workshops

The virtual IMS2020 conference showcased the latest V15 release of Cadence AWR Design Environment® software in three microwave applications (MicroApps) and three industry workshops.

MicroApps

- AWR AXIEM® EM Simulation for Complex ICs and PCBs
  Dr. John Dunn, Cadence
- Network Synthesis to Streamline PA Design Flow
  Chris Bean, Cadence
- Parallel and Remote Schematic Simulation
  Dustin Hoekstra, Cadence

Watch these MicroApps at www.awr.com/tv/v15.

Industry Workshops

- Best Practices for Efficient EM Simulation
  Dr. John Dunn, Cadence
- Understanding 5G System-Level Evaluation
  Dr. Gent Paparisto and Dr. Takao Inoue, Cadence
- Design Tutorial for a High-Efficiency GaN Doherty PA
  David Vye, Cadence

Coming soon to www.cadence.com/go/awr.

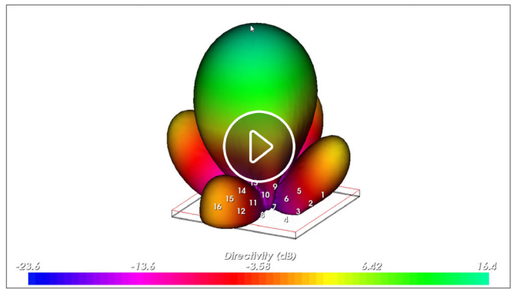
V15 Playlist Now on AWR.TV

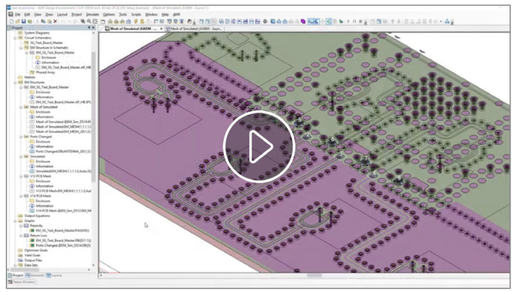
The latest V15 release of Cadence AWR Design Environment software brings RF/microwave design solutions to the Cadence software portfolio for monolithic microwave integrated circuit (MMIC)/RFIC, package/module, and PCB designs. The release provides key new features, add-on modules, and enhancements driven by 5G, automotive, and aerospace and defense applications.

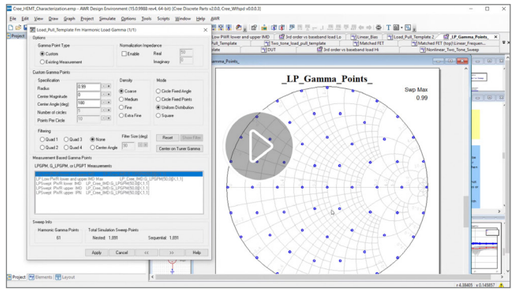
A new AWR.TV YouTube Channel video playlist enables users to take a deep dive into the key V15 software features, which are highlighted in seven videos:

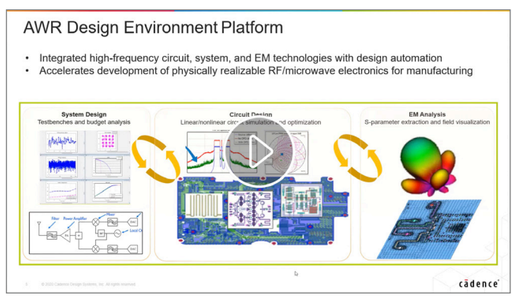
- New Antenna Measurements
- New EM Features
- New Interface Features
- Integrated Transmission Line Calculator
- New Network Synthesis Capabilities
- New System Simulation Capabilities
- Enhanced Load-Pull Capabilities
- Parallel and Remote Schematic Simulation and Optimization
- Enhanced AXIEM EM Capabilities for IC and PCB
- Network Synthesis for Antenna Matching

View playlist at www.awr.tv.









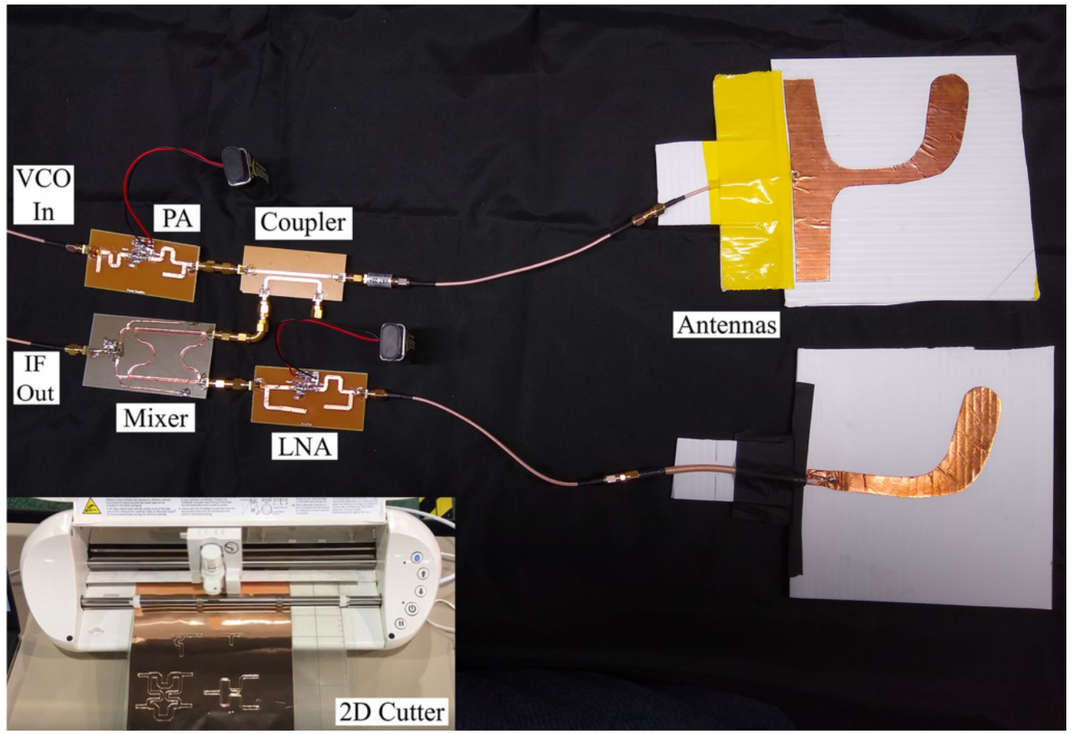
NCSU Rabbit Radar – Design, Simulate, and Build Your Own Radar at Home

This exciting webinar by Professor David S. Ricketts of North Carolina State University is now available for on-demand viewing. It describes how to design, simulate, and build a 2.4GHz frequency modulated continuous wave (FMCW) radar at home or in a lab.

It begins with a short theory session followed by an explanation of the key components of an FMCW radar, which include a mixer, power amplifier, coupler, low noise amplifier, and filters. The actual design and simulations are accomplished with Cadence AWR software, allowing attendees to design the system and microstrip components, and verify using electromagnetic (EM) simulation.

Files, detailed design tutorials, and fabrication parts list can all be found at www.rickettslab.org/rabbitradar.

Register to watch at www.awr.com/rabbit-radar.



RESOURCE **SPOTLIGHT**

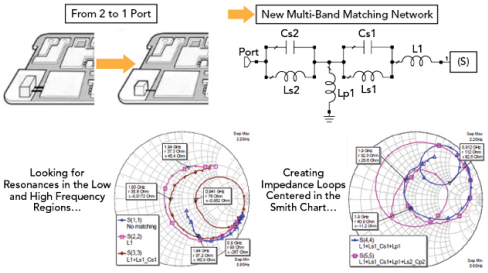
Recent Articles

Efficient Design Flow for 5G NR Front-End Components

Highlights TMYTEK's BBox beamformer box and how the design process for its filter and antenna components was streamlined with the use of the filter synthesis and phased array generator wizards in the Cadence AWR Design Environment platform, saving significant time for the initial design.

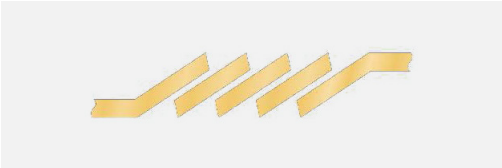
AI and ML Add New Capabilities to EDA Tools

Features contributions from RF EDA vendors on their various capabilities for AI and ML. AWR Design Environment software is featured and highlights the Network Synthesis wizard.



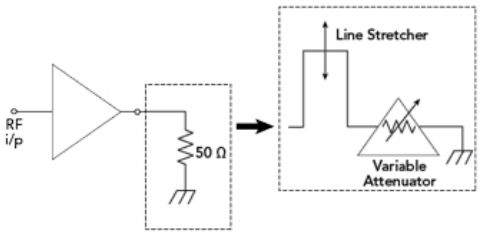
Design of a Miniature X-Band Edge-Coupled Microstrip Bandpass Filter

Presents a straightforward and largely nonmathematical method for designing an edge-coupled, bandpass filter for X-band operations (8.4 - 9.3GHz) with a combination of filter synthesis, closed-form edge-coupled transmission-line models, and EM analysis.



Analyzing the VSWR Withstand Capability of a Balanced Amplifier

Examines the converse problem, namely determining the VSWR presented to the two internal amplifiers—hence transistors—when a mismatch is presented at the amplifier's external port.



Explore more articles at www.awr.com/articles.

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