

Department of  
**Electrical and Electronics Engineering**

# Thunder Trends

Technical Magazine

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**Chief Advisor** ✓

Dr. G. Venkateswarlu

**Chief Editor**

N. Shanthi Kumari

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**NARAYANA**

**ENGINEERING COLLEGE :: NELLORE**

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## Vision of the Institute

To be one of the nation's premier Institutions for Technical and Management Education and a key contributor for Technological and Socio-economic Development of the Nation.

## Mission of the Institute

- To produce technically competent Engineers and Managers by maintaining high academic standards, world class infrastructure and core instructions.
- To enhance innovative skills and multi disciplinary approach of students through well experienced faculty and industry interactions.
- To inculcate global perspective and attitude of students to face real world challenges by developing leadership qualities, lifelong learning abilities and ethical values.

## Vision of the Department

To impart knowledge in the field of Electrical and Electronics Engineering to meet the technical challenges of industry and society with strong innovative skills, leadership qualities and ethics.

## Mission of the Department

- To provide standard training and effective teaching learning process to the students by using the state-of-the-art laboratories, core instruction and efficient faculty.
- To enhance competent, innovative and technical skills amongst the students through training programs by industry and external participation.
- To inculcate leadership qualities, ethical values and lifelong learning skills in learners to serve the society and nation for overall development through value based education.

## Program Educational Objectives (PEOs)

Programme Educational Objectives (PEOs) of B.Tech (Electrical and Electronics Engineering) program are: Within few years of graduation, the graduates will

**PEO-1:** To solve composite problems using mathematics, basic sciences and engineering principles in the domains of testing, design and manufacturing.

**PEO-2:** To achieve higher positions in their profession by demonstrating leadership qualities, research and innovative abilities.

**PEO-3:** To contribute in the field of Electrical and Electronics Engineering to finding solutions for societal problems through their lifelong learning skills and ethical values.

## Program Outcomes (POs)

**PO-1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO-2:** Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO-3:** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO-4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO-5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO-6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO-7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO-8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO-9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO-10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO-11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO-12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Program Specific Outcomes (PSOs)

On completion of the B.Tech. (Electrical and Electronics Engineering) degree, the graduates will be able to

**PSO-1:** Provide alternate solutions to address the problems with specific requirements in the field of Electrical and Electronics Engineering.

**PSO-2:** be ready to work professionally in relevant industries like power systems, control systems and software industries.

**Trend 1: Modular Turbine Design**

We constantly claims of how “bigger is better” because this is the conventional wisdom. Even in the power generation arena, this has been the trend for the last one century. Massive size, which was the only engineering technology then, was used to build centralized power plants. What was the thinking behind this idea? Increase in unit size was accompanied by less capital and production costs. However, those kinds of designs have since begun to disappear. Large power plants require considerable installation work. Due to this, they cannot suit fluctuating demand easily. Transmission grids need a lot of stability, which is offered by smaller-scale units. That is the genesis of modular turbine design. Modularity simply refers to the prefabricated electric generating equipment that is packaged, the aim being to reduce the timeline used to construct a power plant. This method has reduced the cost of gas turbines and helped some power plants gain some market share. Please note that apart from gas turbines, other components of the power plant can also be modular. These include:

1. Heat Recovery Steam Generator (HRSG)
2. Generators
3. Emissions Control Equipment

We expect to see more of these modular designs in 2018 and beyond.

**Trend 2: Change From Coal to Natural Gas**

In the United States, power plants still use a lot of coal. Away from that, interesting things have been happening and we expect them to continue into 2018. For some years now, the use of natural gas has been increasing as coal declines. Where is this confidence coming from? About ten years ago, analysts had predicted a substantial increase in electricity prices upon the closure of coal power plants. Research by Spark Of Freedom Foundation has shown that despite coal's market share reducing by 18 percent from 2008 to 2016, power prices rose by a mere 1 percent annually. This means that natural gas power plants are offering something awesome. The awesomeness is in the efficiency of power generation. First, natural gas power plants are cheap to install. It is also more efficient and generally less expensive. This year (2018), many coal power plants are expected to retire, and they are most likely going to be replaced by natural gas power plants. Consumers, especially those in the US need not worry because of these shutdowns. Electricity prices are usually adjusted with the inflation rate so they remain relatively stable. Furthermore, natural gas is a low cost source that should not affect prices a lot.

**Trend 3: Renewables Backed By Energy Storage**

This is not the first time that battery energy storage has elicited hopes, but at least we already know that large scale systems have been inexistent hitherto. Intermittency has been the major obstacle for renewables, and that seems to be demolition path in 2018. Siemens, Tesla and other bigwigs have already set their eyes on large-scale battery storage, so there is enough reason for players in renewable power generation to be optimistic. This report by Bloomberg New Energy Finance cements this argument.

**Trend 4: Enhanced Capability of Distribution Grids**

A lot of transformation is happening within the electricity system, with many technological innovations disrupting the conventional models of generation and distribution. These disruptions have produced three major disruptions: Electrification, Decentralization and Digitalization.

As these disruptions take root in 2018, you can expect more blurred demarcations between customers, producers and distributors. As we have witnessed in the internet and media industry, power customers will most likely participate in a very different way. In the midst of all these dynamics, the distribution grid is becoming more efficient, as it diversifies from its conventional role of supply. Decentralization of the electricity system coupled with smarter technology should translate into better asset utilization, more security and enhanced reliability. This can only mean growth for associated businesses and services.

**Conclusion**

If you are in the power generation and want to have a head start for future success, you may want to take note of these trends in power generation that are related to efficiency. At ARANER, we are pleased to help you not only succeed on your current ventures, but also prepare for future power generation technologies.



**Dr. G. Srinivasulu**  
Principal, NECN

Industry 4.0, also known as the Fourth Industrial Revolution, is the next phase of the evolution of manufacturing, characterized by the integration of advanced technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and robotics. The goal of Industry 4.0 is to create smart factories that can operate autonomously with minimal human intervention, while still producing high-quality products at a low cost. In this essay, we will explain the concept of Industry 4.0, its technologies, challenges, and benefits.

### 1. Introduction to Industry 4.0

The first industrial revolution began in the late 18th century with the introduction of the steam engine and mechanized production. The second industrial revolution occurred in the late 19th and early 20th centuries with the advent of electricity, the assembly line, and mass production. The third industrial revolution, also known as the digital revolution, began in the late 20th century with the introduction of computers and automation.

Industry 4.0 builds upon the previous three industrial revolutions by integrating advanced technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and robotics. Industry 4.0 aims to create a smart factory that can operate autonomously with minimal human intervention, while still producing high-quality products at a low cost.

### 2. Key technologies of Industry 4.0

Industry 4.0 relies on a number of key technologies to create a smart factory. These technologies include:

#### 2.1 Internet of Things (IoT)

The Internet of Things (IoT) refers to the network of physical devices, vehicles, buildings, and other objects that are embedded with sensors, software, and connectivity that enable them to exchange data. In Industry 4.0, IoT sensors are used to collect data on the performance of machines, the condition of equipment, and the movement of products and materials through the factory.

#### 2.2 Big Data Analytics

Big data refers to the large volume of data – both structured and unstructured – that is generated by the sensors, machines, and other devices in the factory. Big data analytics is the process of examining this data to uncover hidden patterns, correlations, and other insights that can be used to improve the efficiency and productivity of the factory.

#### 2.3 Artificial Intelligence (AI)

Artificial intelligence (AI) refers to the ability of machines to perform tasks that normally require human intelligence, such as perception, reasoning, learning, and problem-solving. In Industry 4.0, AI is used to analyze big data, optimize production processes, and make real-time decisions based on changing conditions in the factory.

#### 2.4 Robotics

Robots are used in Industry 4.0 to perform a wide range of tasks, from assembly and painting to welding and packaging. In smart factories, robots are connected to the IoT and can be controlled and programmed remotely.

#### 2.5 Additive Manufacturing

Additive manufacturing, also known as 3D printing, is a process of creating three-dimensional objects by building up layers of material. Additive manufacturing is used in Industry 4.0 to produce prototypes, customized products, and spare parts on demand, without the need for expensive tooling or molds.

### 3. Challenges of Industry 4.0

While Industry 4.0 offers many benefits, it also presents a number of challenges. These challenges include:

#### 3.1 Cybersecurity

As the factory becomes more connected, the risk of cyber-attacks increases. Cybersecurity is a major challenge in Industry 4.0, and manufacturers must take steps to secure their networks, devices, and data.

#### 3.2 Skills Gap

Industry 4.0 requires a new set of skills, including data analytics, AI, and robotics. However, there is a skills gap in the workforce, with many manufacturers struggling to find workers with the necessary expertise. To overcome this challenge, manufacturers need to invest in training and education programs to upskill their workforce.

#### 3.3 Interoperability

Industry 4.0 relies on a complex ecosystem of technologies, devices, and software systems, which can be challenging to integrate and operate together seamlessly. Interoperability is a major challenge in Industry 4.0, and manufacturers need to ensure that their systems are compatible with each other and can exchange data smoothly.

### 4. Benefits of Industry 4.0

Despite the challenges, Industry 4.0 offers many benefits to manufacturers, including:

#### 4.1 Increased Efficiency

Industry 4.0 technologies such as IoT, big data, and AI can help manufacturers optimize production processes and reduce waste, leading to increased efficiency and lower costs.

#### 4.2 Improved Quality

Smart factories can use sensors and data analytics to monitor production processes in real-time, allowing manufacturers to identify and address quality issues before they become a problem.

#### 4.3 Flexibility

Industry 4.0 technologies such as additive manufacturing and robotics allow manufacturers to produce customized products and respond quickly to changing customer demands.

#### 4.4 Better Resource Management

By using sensors and data analytics, manufacturers can optimize their use of resources such as energy, water, and raw materials, leading to reduced environmental impact and lower costs.

#### 5. Conclusion

In conclusion, Industry 4.0 represents the next phase of the evolution of manufacturing, characterized by the integration of advanced technologies such as IoT, big data, AI, and robotics. While Industry 4.0 presents challenges such as cybersecurity, skills gaps, and interoperability, it also offers many benefits such as increased efficiency, improved quality, flexibility, and better resource management. To fully realize the potential of Industry 4.0, manufacturers need to invest in the necessary technologies, skills, and infrastructure, and work collaboratively to address the challenges and opportunities of this new era of manufacturing.



**YUKTHA SHARMA**  
Roll No. 17711A02B7, II EEE

5G wireless technology is the latest generation of mobile networking technology that promises faster data speeds, lower latency, and more reliable connections. In the first half of 2019, 5G was one of the most significant trends in the field of telecommunications, with a focus on developing networks that can support faster data speeds and higher bandwidth. In this article, we will explore the key features and benefits of 5G, the challenges of its deployment, and its potential applications in various industries.

#### 1. Introduction

5G wireless technology is the latest iteration of mobile networking technology, succeeding the previous generations of 4G, 3G, and 2G. 5G is expected to provide faster data speeds, lower latency, and more reliable connections, which will enable a wide range of new applications and services. In the first half of 2019, the development and deployment of 5G networks were major trends in the telecommunications industry, with many countries and companies investing heavily in the infrastructure and technologies required to support 5G.

#### 2. Key Features of 5G

##### 2.1 Faster Data Speeds

One of the key features of 5G is its ability to deliver faster data speeds than previous generations of mobile networking technology. 5G is expected to provide download speeds of up to 20 gigabits per second (Gbps) and upload speeds of up to 10 Gbps, which is significantly faster than the average speeds of 4G networks.

##### 2.2 Lower Latency

Another key feature of 5G is its lower latency, which refers to the time it takes for a signal to travel from a device to a network and back. 5G is expected to have a latency of around 1 millisecond (ms), which is up to 10 times faster than the average latency of 4G networks. This lower latency will enable real-time communication between devices, which is essential for applications such as autonomous vehicles, virtual reality, and remote surgery.

##### 2.3 Higher Bandwidth

5G also offers higher bandwidth than previous generations of mobile networking technology, which refers to the amount of data that can be transmitted over a network at any given time. 5G networks use higher-frequency radio waves than 4G networks, which allows them to transmit more data at once.

This higher bandwidth will enable the development of new applications and services that require large amounts of data, such as streaming 4K and 8K video and augmented reality.

### **3. Benefits of 5G**

#### **3.1 Improved Network Performance**

5G networks offer faster data speeds, lower latency, and higher bandwidth than previous generations of mobile networking technology. This will result in improved network performance, with fewer dropped calls, faster downloads and uploads, and more reliable connections. This improved network performance will benefit both consumers and businesses, enabling new applications and services that were previously not possible.

#### **3.2 New Applications and Services**

5G networks will enable the development of new applications and services that were previously not possible. For example, 5G will enable the development of autonomous vehicles, which require real-time communication between vehicles and the network to operate safely. 5G will also enable the development of virtual reality and augmented reality applications, which require fast data speeds and low latency to provide a seamless user experience.

#### **3.3 Enhanced Mobile Broadband**

5G will also enhance mobile broadband services, enabling faster downloads and uploads, and better coverage and reliability. This will enable consumers to stream high-quality video and audio content on their mobile devices, without buffering or interruptions. It will also enable businesses to use mobile broadband for applications such as video conferencing, remote monitoring, and cloud computing.

### **4. Challenges of 5G Deployment**

#### **4.1 Infrastructure Requirements**

One of the main challenges of 5G deployment is the infrastructure requirements. 5G networks use higher-frequency radio waves than 4G networks, which means that they require more cell sites and base stations to provide coverage. This means that telecommunications companies will need to invest heavily in infrastructure to support 5G, including building new cell sites and upgrading existing ones.

#### **4.2 Spectrum Availability**

Another challenge of 5G deployment is the availability of spectrum. Spectrum refers to the range of radio frequencies used for wireless communication.

5G networks require access to a large amount of spectrum, including both low-frequency and high-frequency bands. However, many of these bands are already in use by other wireless technologies, such as television broadcasting and satellite communication. This means that regulators will need to make more spectrum available for 5G networks, which could take time and require significant investment.

#### **4.3 Cost**

The cost of deploying 5G networks is another challenge. Building new cell sites and upgrading existing ones requires significant investment, and telecommunications companies will need to make substantial investments in equipment and infrastructure to support 5G. This cost could be passed on to consumers, who may need to pay more for 5G services than they do for 4G services.

### **5. Potential Applications of 5G**

#### **5.1 Autonomous Vehicles**

5G networks will enable the development of autonomous vehicles, which require real-time communication between vehicles and the network to operate safely. 5G will provide the low latency and high bandwidth required for real-time communication, enabling vehicles to communicate with each other and with the network to avoid collisions and operate safely.

#### **5.2 Virtual and Augmented Reality**

5G networks will also enable the development of virtual and augmented reality applications, which require fast data speeds and low latency to provide a seamless user experience. 5G will provide the bandwidth and latency required for these applications, enabling users to interact with virtual objects in real-time.

#### **5.3 Smart Cities**

5G networks will also enable the development of smart cities, which use sensors and other technologies to improve the efficiency of city services such as transportation, energy, and public safety. 5G will provide the connectivity required to support these sensors and enable real-time communication between devices.

### **6. Conclusion**

In conclusion, 5G wireless technology was a significant trend in the first half of 2019, with many countries and companies investing heavily in the infrastructure and technologies required to support 5G networks. 5G offers faster data speeds, lower latency, and higher bandwidth than previous generations of mobile networking technology,

enabling a wide range of new applications and services. However, the deployment of 5G networks poses significant challenges, including infrastructure requirements, spectrum availability, and cost. Despite these challenges, the potential applications of 5G, including autonomous vehicles, virtual and augmented reality, and smart cities, make it a promising technology for the future.



**VELLAPALEM KEERTHI REDDY**  
Roll No.17711A02B1, II EEE

### How 5G will help in VR technology

Virtual reality (VR) technology has the potential to revolutionize many industries, from entertainment to education to healthcare. However, one of the main limitations of VR has been the need for fast data speeds and low latency to provide a seamless user experience. This is where 5G wireless technology comes in. In this article, we will explore how 5G will help in VR technology in the first half of 2019.

#### 1. Faster Data Speeds

One of the main advantages of 5G wireless technology is faster data speeds. 5G networks have the potential to offer data speeds up to 100 times faster than 4G networks, with peak speeds of up to 20 gigabits per second (Gbps). This means that VR applications and content can be streamed and downloaded much more quickly than before, allowing for a more seamless and immersive user experience.

#### 2. Lower Latency

Another key advantage of 5G is lower latency. Latency refers to the delay between a user's action and the system's response. In VR applications, low latency is essential to create a realistic and immersive experience. With 5G, latency can be reduced to as little as 1 millisecond, compared to around 20 milliseconds for 4G networks. This means that users can move and interact with objects in virtual environments in real-time, without experiencing any lag or delay.

#### 3. High Bandwidth

5G networks also offer higher bandwidth than previous generations of mobile networking technology. This means that more data can be transmitted simultaneously, which is important for VR applications that require large amounts of data to be transmitted in real-time. High bandwidth also means that multiple users can use VR applications simultaneously without experiencing any lag or delay.

#### 4. Remote Rendering

One of the most exciting applications of 5G in VR technology is remote rendering. Remote rendering involves offloading the rendering of complex VR content to remote servers, which are accessed via a 5G network. This means that VR content can be rendered in real-time on powerful remote servers, which reduces the processing load on the user's device. This allows for more complex and realistic VR environments to be created and experienced on devices that may not have the processing power to render them locally.

#### 5. Cloud Gaming

5G also has the potential to revolutionize cloud gaming. Cloud gaming involves streaming games from remote servers, rather than downloading and installing them locally. With 5G, cloud gaming can be streamed in real-time with minimal latency, which means that users can play high-quality games on their VR devices without the need for a high-end gaming PC or console. This could make VR gaming more accessible to a wider audience, as it would reduce the cost of entry.

#### 6. Telepresence

Telepresence is another potential application of 5G in VR technology. Telepresence involves using VR technology to create a sense of presence in a remote location, allowing users to feel as though they are physically present in that location. With 5G, telepresence can be enhanced by using multiple cameras and sensors to capture and transmit data in real-time. This means that users can interact with remote environments and objects as if they were physically there.

#### 7. Challenges

Despite the potential advantages of 5G in VR technology, there are also several challenges that need to be addressed. One of the main challenges is the need for significant investment in infrastructure to support 5G networks. This includes building new cell sites and upgrading existing ones, which can be expensive and time-consuming. Another challenge is the availability of spectrum for 5G networks, as many of the necessary bands are already in use by other wireless technologies.

However, the World Health Organization (WHO) has stated that the current evidence does not suggest any adverse health effects from exposure to 5G networks.

Another challenge is the need for VR content that takes advantage of 5G technology. While faster data speeds and lower latency are important, there also needs to be content that can take advantage of these features. This requires investment in VR content development, which can be expensive and time-consuming.

Finally, there is also a need for VR devices that are capable of taking advantage of 5G technology. While there are currently VR devices on the market that support 5G, they are relatively expensive and not widely available. As 5G networks become more widespread, there will be a need for affordable VR devices that can take advantage of the new technology.

Despite these challenges, the potential benefits of 5G in VR technology are significant. By offering faster data speeds, lower latency, and higher bandwidth, 5G can help to create more immersive and realistic VR experiences. With the potential to revolutionize industries such as gaming, education, and healthcare, 5G is likely to be a key driver of VR technology in the years to come.

**THUMMALA SREENADH**  
Roll No.17711A02A2, II EEE

### BLDC development in 2019

In the first half of 2019, there were several developments in the field of Brushless DC (BLDC) motors. BLDC motors are widely used in various applications such as electric vehicles, drones, robotics, and industrial automation due to their high efficiency, low maintenance, and long life. Here are some of the key developments in the first half of 2019:

**1. Integration with IoT:** BLDC motors were integrated with the Internet of Things (IoT) to improve their performance and efficiency. IoT-enabled BLDC motors can be remotely monitored and controlled, allowing for real-time feedback on their performance and energy consumption. This can lead to better maintenance and reduced downtime.

**2. Improved efficiency:** There were several developments in the design of BLDC motors aimed at improving their efficiency. For example, researchers at the University of Texas at Arlington developed a new type of BLDC motor with a higher power density and efficiency compared to traditional BLDC motors. This was achieved by using a new type of magnetic material that allows for higher magnetic flux density.

**2. Use of rare-earth-free magnets:** BLDC motors typically use rare-earth magnets such as neodymium and samarium-cobalt. However, the mining and processing of these materials can be environmentally damaging and expensive. In the first half of 2019, there were several developments in the use of rare-earth-free magnets in BLDC motors. For example, researchers at the Fraunhofer Institute for Manufacturing Technology and Advanced Materials in Germany developed a new type of BLDC motor that uses a magnet made of iron, cobalt, and carbon. This reduces the environmental impact and cost of the motor.

**3. Use in electric vehicles:** BLDC motors are widely used in electric vehicles due to their high efficiency and low maintenance. In the first half of 2019, there were several developments in the use of BLDC motors in electric vehicles. For example, researchers at the Indian Institute of Technology Delhi developed a new type of BLDC motor that can be used in electric cars. This motor has a higher power density and efficiency compared to traditional BLDC motors.

**4. Use in drones and robotics:** BLDC motors are also widely used in drones and robotics due to their high efficiency and low maintenance. In the first half of 2019, there were several developments in the use of BLDC motors in these applications. For example, researchers at the University of California, San Diego developed a new type of BLDC motor that can be used in small drones. This motor is more efficient and has a higher power-to-weight ratio compared to traditional BLDC motors.

**5. Use in industrial automation:** BLDC motors are also used in industrial automation applications such as conveyor systems, packaging machines, and CNC machines. In the first half of 2019, there were several developments in the use of BLDC motors in these applications. For example, researchers at the University of Sheffield in the UK developed a new type of BLDC motor that can be used in CNC machines. This motor has a higher torque density and efficiency compared to traditional BLDC motors.



**LINGAREDDY VINOOTH**  
Roll No. 17711A0269, II EEE