A.V.C COLLEGE OF ENGINEERING, MANNAMPANDAL, MAYILADUTHURAI

Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai

Reaccredited by NAAC with 'B++ (2nd cycle) 'Grade, an ISO 9001:2015 certified institution

Department of Electronics and Communication Engineering

(Accredited by NBA)

"LEMON NEWSLETTER"

Volume: 12 ***Month: February'24*** ***Issue: 01***

Message from Head of the Department

I wish the students to be focused and concentrate more in their studies and score high marks in the forthcoming exams.

I wish the students to actively participate in all the cocurricular and extracurricular activites.

I expect from the faculties for their lively conduction of Faculty development programmes and workshops in the department to acquire knowledge in recent trends.

Dr. CHITRAVALAVAN

HOD/ECE

Life Quotes

"There are only two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle."

- Albert Einstein

"Life is what happens when you're busy making other plans."

- John Lennon

"The purpose of our lives is to be happy."

- Dalai Lama

"All you need in this life is ignorance and confidence; then success is sure."

- Mark Twain

"The longer I live, the more beautiful life becomes."

- Frank Lloyd Wright

Faculty Corner:

Microwave Tecnology and its future trends

- ***Dr.K.R.Vinothini, ASP/ECE***

The RF and microwave industry remains at the forefront of telecommunications, defense, and aerospace, where the demand for higher frequencies and bandwidths is soaring. The deployment of 5G and increasing reliance on satellite communications will have significant impacts throughout the year. The industry also faces challenges, including needing cost-effective, miniaturized, and energy-efficient components. Rather than attempting to cover every application, I've decided to focus on some of the important and some, like quantum, that are years away from realization but will be a massive market for us when they arrive.

Reconfigurable Surfaces

The evolution of RF and microwave technology is closely linked to materials science, and one of the most promising technologies right now is reconfigurable surfaces that control the phase, amplitude, frequency, and polarization of incoming electromagnetic waves. By adjusting these parameters, these surfaces can direct or shape the propagation path of these waves. In wireless networks, they can be used to improve signal quality by redirecting signals towards intended receivers. Since they can more efficiently direct signals, they can reduce the DC power requirements of transmitters, which is a benefit for IoT devices and other battery-operated devices in which power efficiency is crucial.

The potential applications of reconfigurable surfaces go beyond improving wireless communications. They could be pivotal in areas like radar technology, medical imaging, and even in the development of cloaking technologies that make objects less detectable to electromagnetic waves.

Advances in Packaging

Advanced packaging technology will play a crucial role in the future development of microwave components. By reducing the distance between interconnected components, signal transmission can be faster and more efficient and advanced packaging techniques can help reduce signal loss and crosstalk between components, improve heat dissipation, and reduce costs.

One impressive advancement is Advanced Glass Packaging Technology (AGPT) developed by ED2 Corporation, which uses fused silica, a type of synthetic quartz, as the primary substrate in heterogeneous semiconductor packaging. Fused silica has exceptional thermal conductivity and a low dielectric constant, which enables efficient heat dissipation and faster signal transmission within the package. This improves performance and stability, especially for high-power and high-frequency applications.

AGPT (and heterogeneous semiconductor packaging in general) combines multiple types of semiconductor materials within a single package, including silicon and compound semiconductors such as gallium nitride alone or in combination. AGPT is well-suited for 2.5D and 3D integration techniques, where multiple chips are stacked vertically, which makes it possible to create highly complex multifunction modules with reduced footprints and improved performance.

Another significant development is PolyStrata technology from Nuvotronics. This Cubic Corporation subsidiary has spent the last 16 years developing the technology, which resulted in the world's first 3D air-

dielectric circuit board. PolyStrata technology is an air-dielectric circuit board that uses tiny, metal-coated channels embedded within a polymer substrate to carry electrical signals. The channels, known as micro-coaxial transmission lines, offer superior electrical properties compared to traditional planar circuits. Circuits designed with the technology have been shown to show a 10 to 100 times improvement in size, weight, and power.

The technology also delivers lower loss, higher isolation, better thermal management, and the ability to handle high RF power levels. In addition, PolyStrata allows seamless integration of devices fabricated in different technologies, such as GaN, SiGe, and silicon, within a single package. The result is smaller, lighter, and more efficient, components with superior electrical and thermal properties than traditional planar circuits. The Nuvotronics wideband 90-degree hybrid coupler family showcases these properties well.

Integration of AI and Machine Learning

We've all been hearing about AI for years, but when OpenAI launched ChatGPT, it finally became something tangible for mere mortals, and it's now virtually impossible to read the news without constantly being bombarded with the latest developments. That said, AI and machine learning will play a significant role in RF and microwave technology because AI algorithms can optimize network performance, predict the need for maintenance, and enhance signal processing capabilities. Integrating AI in RF systems will lead to more intelligent, adaptive, and efficient communication networks.

Satellite Communications

While it has yet to happen, Starlink and eventually other satellite broadband providers using low Earth orbit (LEO) satellites will need spectrum higher than Ka-band. V-band at 40 to 75 GHz is a likely target, as well as E-band (60 to 90 GHz) because they offer immense available spectrum required to achieve higher data rates that will ultimately be needed for applications such as high-definition video streaming, large data transfers, and "direct-to-cell" wireless services. The next step for cellular technology is the integration of satellite networks with terrestrial microwave systems that will expand coverage to places still underserved (or not served at all) by terrestrial networks.

This will require ground stations and user terminals capable of communicating effectively with terrestrial networks and satellite constellations. Developments in microwave antenna design, such as phased array antennas, allow for more precise and dynamic beamforming and enable rapid repositioning of antenna beams, essential for tracking satellites in lower orbits.

Microwave Technology In Defense Systems

The defense industry in the US is currently undergoing its greatest challenges since the end of the Cold War, as stocks of everything from ammunition to air defense systems must be replenished after two years of war in Ukraine and, most recently, supporting the Israeli Defense Force. From a technological perspective, advances in microwave technology for defense will significantly improve, spanning communication and surveillance to weaponry and electronic warfare. Microwave technology advancements will enable radar systems to achieve higher-resolution imaging, which is crucial for accurately identifying and tracking smaller or more distant targets. Improvements in Active Electronically Scanned Array (AESA) radars powered by GaN devices will continue to replace vacuum electron devices to deliver RF power and allow for more agile and accurate tracking of multiple targets simultaneously.

Although lasers get most of the media attention, high-power microwave (HPM) direct energy weapons will play an increasingly important role in the coming years because they have benefits that lasers do not.

For example, while microwave and lightwave energy travel at the same speed, their capabilities are different. It takes longer for a laser to fire, and the beam must reside on the target long enough to destroy it. Although firing a laser is far less expensive than a missile, the effect is the same: one laser shot (hopefully) equals one dead drone (or in recent examples, a few. In contrast, HPM fires in less than a second, has a deep magazine (i.e., the ability to fire many times), and can simultaneously destroy or degrade multiple targets.

//It's a great time to be a microwave engineer//

Student Corner :

THE FUTURE OF SPACE TOURISM

- ***J.Mohammed Hisam, III ECE***

Space tourism is an industry that has been growing rapidly in recent years, with the potential to become one of the most lucrative industries in the world. While the industry is still in its infancy, the demand for space travel is growing, and it is expected to continue to expand at a annual growth rate of 40.2% from 2023 to 2030. In 2022, the global space tourism market was valued at USD 695.1 million, and it is projected to reach USD 8,669.2 million by 2030.

The government end-user segment is also expected to grow at a CAGR of 37% from 2022 to 2030. In the United States, North America led the overall market in 2022, with a market share of 38.6%. The region has a well-established infrastructure that has allowed for the speedier implementation of modern technologies, and the presence of an extensive research and development base.

There are two types of space tourism: sub-orbital and orbital.

SUBORBITAL SPACEFLIGHT

The sub-orbital segment dominated the market in 2022, accounting for 49.3% of the overall market share and aims to reach an altitude of over 300,000 feet, reaching the Karman line, which is the benchmark to define where outer space begins. Currently there are two major players competing in this field, Virgin Galactic, part of Richard Branson's empire and Blue Origin, run by Amazon's billionaire founder Jeff Bezos. Both of the companies' systems are rocket-powered and capable of carrying up to six passengers on a flight. Virgin has completed four successful flights however recently filed for bankruptcy after failing to find funding, Blue origin however has now flown 32 passengers on the New Sheppard alongside a number of uncrewed flights carrying payloads onboard.

ORBITAL SPACEFLIGHT

Unlike suborbital spaceflight which gives passengers a few minutes in space at an altitude of 300,000 feet, orbital spaceflight goes much further than this. Passengers are likely to spend between a few days in space up to over a week at an altitude of over 1.3 million feet. The final quarter of 2021 is likely to be a huge for tourists in orbital spaceflight, with two major companies Space Adventures and Axiom Space announcing up to nine seats to orbit available for purchase by either individuals or organizations.

The sub-orbital segment dominated the market in 2022, accounting for 49.3% of the overall market share. The orbital segment, on the other hand, is expected to witness the fastest growth of 41.0% throughout the forecast period. The demand for space tourism is expected to continue to grow in the coming years, as the cost of space travel decreases and more people become interested in the experience.

CURRENT SPACE TOURISM COMPETITORS AND MISSIONS

Whilst still relatively new the space tourism industry already has several key players:

- SpaceX
- Blue Origin
- Orion Span
- Boeing
- Zero-G
- Space Adventure
- Zero 2 Infinity
- World View
- Space Perspective
- Nanoracks

These companies are working to develop new technologies and services that will make space travel more accessible and affordable for a broader market.

WHERE IS SPACE TOURISM BOOMING?

North America is leading the way in the space tourism market, with a well-established infrastructure and an extensive research and development base. Europe, although behind America in the market, is also showing potential in the space tourism industry, with the U.K. government pledging £2 million to fund horizontal space launches from the country.

The U.K. has emerged as a region leader for spaceports, which could then transition into more opportunities for space tourism in Europe. However, the COVID-19 pandemic and the war in Ukraine have been detrimental to building the European space tourism market, with space activities and funding being diverted elsewhere. To keep up with the US, Europe needs to scale launch capabilities.

BUT SPACE TOURISM IS NOT WITHOUT ITS CHALLENGES

While space tourism offers exciting opportunities, there are also some potential drawbacks and negative effects to consider.

Environmental Impact: Space tourism can have a negative impact on the environment. Launching spacecraft and rockets require a lot of energy and can produce significant amounts of air and noise pollution. These emissions can contribute to climate change and harm the atmosphere.

Safety Concerns: Space travel is still a dangerous endeavor, and accidents can happen. Despite safety protocols, there is always the risk of something going wrong, and the consequences of a mishap could be catastrophic.

Cost: At present, space tourism is an expensive venture that is accessible only to the wealthy. As a result, many people will not be able to experience space travel, which can create feelings of inequality and elitism.

Space Debris: Every launch of a spacecraft generates debris that can stay in orbit for many years, and as the number of space launches increases, the amount of debris grows. This debris can cause problems for other spacecraft, and even small debris can cause damage.

Resource Depletion: Space travel requires a vast amount of resources, including energy, fuel, and materials. The depletion of these resources could have long-term consequences and could negatively impact the environment and the availability of resources for future generations.

Legal Issues: The legal framework for space tourism is still evolving, and it is unclear who will be held responsible if something goes wrong. There are also concerns about the impact of space tourism on international space laws and treaties.

The industry must ensure safety and sustainability, avoiding the mistakes of the past and building a foundation for the future. Including continuing to invest in research and development and ensuring that space travel becomes more accessible and affordable for all.

Objective Type questions on Integrated Circuits

- ***Nikitha Rajam.E, II ECE***

1.Open loop op-amp configuration has
a) Direct network between output and input terminals
b) No connection between output and feedback network
c) No connection between input and feedback network
d) All of the mentioned

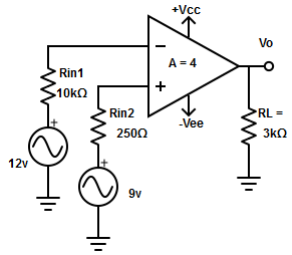
2. In which configuration does the op-amp function as a high gain amplifier?
a) Differential amplifier
b) Inverting amplifier
c) Non-inverting amplifier
d) All of the mentioned

3. How does the open loop op-amp configuration classified?
a) Based on the output obtained
b) Based on the input applied
c) Based on the amplification
d) Based on the feedback network

4. What will be the voltage drop across the source resistance of differential amplifier when connected in open loop configuration?
a) Zero
b) Infinity
c) One
d) Greater than one

5. The output voltage of an open-loop differential amplifier is equal to
a) Double the difference between the two input voltages
b) Product of voltage gain and individual input voltages
c) Product of voltage gain and the difference between the two input voltages
d) Double the voltage gain and the difference between two input voltages

6. Calculate the output voltage for the given circuit.



a) V_o = 7v
b) V_o = 5.9v
c) V_o = 12v
d) V_o = 11.4v

7. Find the output of inverting amplifier?
a) $V_o = AV_{in}$
b) $V_o = -AV_{in}$
c) $V_o = -A(V_{in1} - V_{in2})$
d) None of the mentioned

8. Determine the output voltage for the non-inverting amplifier input voltage 37µVpp sinewave. Assume that the output is a 741.
a) -7.44 Vpp sinewave
b) 74 Vpp sinewave
c) 7.4Vpp sinewave
d) 0.7 Vpp sinewave

9. What happen if any positive input signal is applied to open-loop configuration?
a) Output reaches saturation level
b) Output voltage swing's peak to peak

c) Output will be a sine waveform
d) Output will be a non-sinusoidal waveform

10. Why open-loop op-amp configurations are not used in linear applications?
a) Output reaches positive saturation
b) Output reaches negative saturation
c) Output switches between positive and negative saturation
d) Output reaches both positive and negative saturation

Answers:

1. a) Direct network between output and input terminals
2. d) All of the mentioned
3. b) Based on the input applied
4. a) Zero
5. c) Product of voltage gain and the difference between the two input voltages
6. c) $V_o = 12v$
7. b) $V_o = -AV_{in}$
8. c) 7.4Vpp sinewave
9. a) Output reaches saturation level
10. c) Output switches between positive and negative saturation

TRICKY PUZZLES

- Abirami. S, II ECE

1. You have a basket containing ten apples. You have ten friends, who each desire an apple. You give each of your friends one apple.Now all your friends have one apple each, yet there is an apple remaining in the basket. How?

   Answer: You give an apple each to your first nine friends, and a basket with an apple to your tenth friend.Each friend has an apple, and one of them has it in a basket.

2. A poor woman and a rich woman are talking about music.The poor woman says she has studied music and can find a song with any name in it.The rich woman says "OK, if you can find a song with my son's name in it, I will give you a thousand dollars. His name is Demarcus-Jabari."The poor woman gives her answer and is instantly $1,000 richer.What was her answer?

   Answer: "Happy Birthday"

3. A bomb goes off. Carnage .One Person ,Only a few feet away, survives! How can this be?

   Answer: The person was watching it on TV

4. A man walks into a bar and asks the bartender for a glass of water.But the bartender takes out a gun and aims it at the man's head.The man says "Thank You" and walks out.Why?

   Answer: The man had hiccups. He wanted to cure it with a glass of water, but the bartender cured it by giving him a surprise.

Editor's Desk:

Strategies for Emotional Regulation

- *Get in Touch With Your Emotional Fluency.*
- *Turn Your Attention Outward.*
- *Engage in Inner Work Exercises.*
- *Identify Triggers That Heighten Emotions.*
- *Constructive Communication.*
- *Retreat From Hostile Conversation.*
- *Avoid Accusatory words.*
- *Give Others a Turn at Talking.*

Send your suggestions to:

Dr.K.R.Vinothini, AP/ECE –Editor / ***LEMON NEWSLETTER***
lemonece2013@gmail.com

Student Editors :

1. M.Yogeshwaran, IV ECE
2. S.Ashika, IV ECE
3. B.Arooran, III ECE
4. S.Abirami, III ECE

Department Vision

To create globally competent engineers in Electronics and Communication Engineering to meet the industrial progress for betterment of the society

Department Mission

- To create an academic ambience for quality education in the field of Electronics and Communication Engineering
- To make the best use of modern tools and software for teaching and research activities
- To promote industry-institution interaction for skill-based learning of students from rural society
- To inculcate moral and ethical values with a sense of professionalism.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's):

1. To provide the students with a strong foundation in the required sciences in order to pursue studies in Electronics and Communication Engineering.
2. To gain adequate knowledge to become good professional in electronic and communication engineering associated industries, higher education and research.
3. To develop attitude in lifelong learning, applying and adapting new ideas and technologies as their field evolve
4. To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.
5. To inculcate in the students a professional and ethical

attitude and an ability to visualize the engineering issues in a broader social context.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
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.
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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

- PSO1: Design, develop and analyze electronic systems through application of relevant electronics, mathematics and engineering principles
- PSO2: Design, develop and analyze communication systems through application of fundamentals from communication principles, signal processing, and RF System Design & Electromagnetics.
- PSO3: Adapt to emerging electronics and communication technologies and develop innovative solutions for existing and newer problems