DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RISE-MAGAZINE

Recent Innovations In Sophisticated Electronics

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VOLUME 20 JAN-JUN-2022

ECE

DEPARTMENT PROFILE

Electronics and Communication Engineering has emerged as the major driving force in the present day Information Technology revolution. It is acting as a bridge between different disciplines of engineering and technology. It has penetrated into other prominent sectors such as health care, instrumentation, agriculture, automation, signal processing, remote sensing etc.., The recent developments such as IoT, Artificial Intelligence and the mercurial advancements in the field of communication.

Vision

To be a focal centre for academic excellence in competing global standards and dynamics in the field of Electronics and Communication Engineering with research and services focusing on effective communication skills, entrepreneurial, ethical and social concern.

Mission

To impart quality technical education in Electronics and Communication Engineering with well established infrastructure, state- of- the art laboratories, core instructions and cognizant faculty.

To prepare the young and dynamic Electronics and Communication Engineers professionally deft and intellectually adept with knowledge, behaviour and information competency.

To enable the learners for changing trends in the field of Electronics and Communication Engineering with a focus on career guidance, placements and higher education by Industry-Institute relationship.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1. Graduates should be cognizant in basic science, fundamental engineering stream along with core related domains in ECE and Allied fields.

PEO 2. Graduates should understand issues related to design, problem solving, and intellectually adept with knowledge, behavior and information competency.

PEO 3. Graduates should demonstrate their technical, communication, research, aptitudes along with leadership skills in professional environment to empower employability, higher education and entrepreneurs successfully through industry-institute interaction.

PEO 4. Graduate should be motivated with high ethical, human values and team work towards development of the societ.

PROGRAM OUTCOMES

ENGINEERING KNOWLEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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.

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.

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.

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.

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.

ETHICS: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

INDIVIDUAL AND TEAM WORK: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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.

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.

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

PSO 1. An ability to get an employment in Electronics and Communication Engineering field and related industries and to participate & succeed in competitive examinations like GRE, GATE,TOEFL, PSUs, etc.

PSO 2. Should be able to design and test various electronic systems that perform analog and digital processing functions.

E-Textiles

E-textiles, also known as electronic textiles, are fabrics that can function electrically as electronics and behave physically as textiles which enable computing ,digital components and electronics to be embedded in them. Part of the development of wearable technology, they are referred to as intelligent clothing or smart clothing that allow for the incorporation of built-in technological elements in everyday textiles and clothes. It does not strictly encompass wearable computing because emphasis is placed on the technology not being visible on the fabric and a computer is not actually embedded into the fabric. While not part of the mainstream form of fashion, its popularity is increasing and more research is being devoted to it.

The field of e-textiles can be divided into two main categories:

1) The first category involves mounting classical electronic devices such as conducting wires, ICs, LEDs and conventional batteries into garments.

2) The second category involves creating electronic function directly on the textile fibers. These functions can either be passive such as pure wires, conducting textile fibers, or more advanced functions such as transistors, diodes and solar cells. The field of embedding advanced electronic components onto textile fibers is sometimes referred to as fibertronics.

BENEFITS OF E TEXTILES

Electronic textiles, or e-textiles, are a new emerging inter disciplinary field of research, bringing together specialists in information technology, microsystems , materials, and textiles. E textiltes offers the following advantages:

– Flexible

– No wires to snag environment

– Large surface area for sensing

– Invisible to others

– Cheap manufacturing

PROPERTIES OF E – TEXTILES

Electrical properties:

From the electrical points of view, conductivity is the most important factor. Electrical resistance low enough to allow a flow of electric energy, such as for power or data transmission, is critical. Metal, carbon, or optical fibers are typically well-known conductors.

Conductive yarns are either pure metal yarns or composites of metals and textiles. Metals are superior in strength and fineness, and textiles are selected for comfort. In order to produce a successful conductive yarn, the best mix of conductive and non-conductive materials is critical.

As a thread takes on a bigger portion of conductive components, it loses the typical textile properties such as flexibility or drapability and becomes more conductive.

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Spintronics

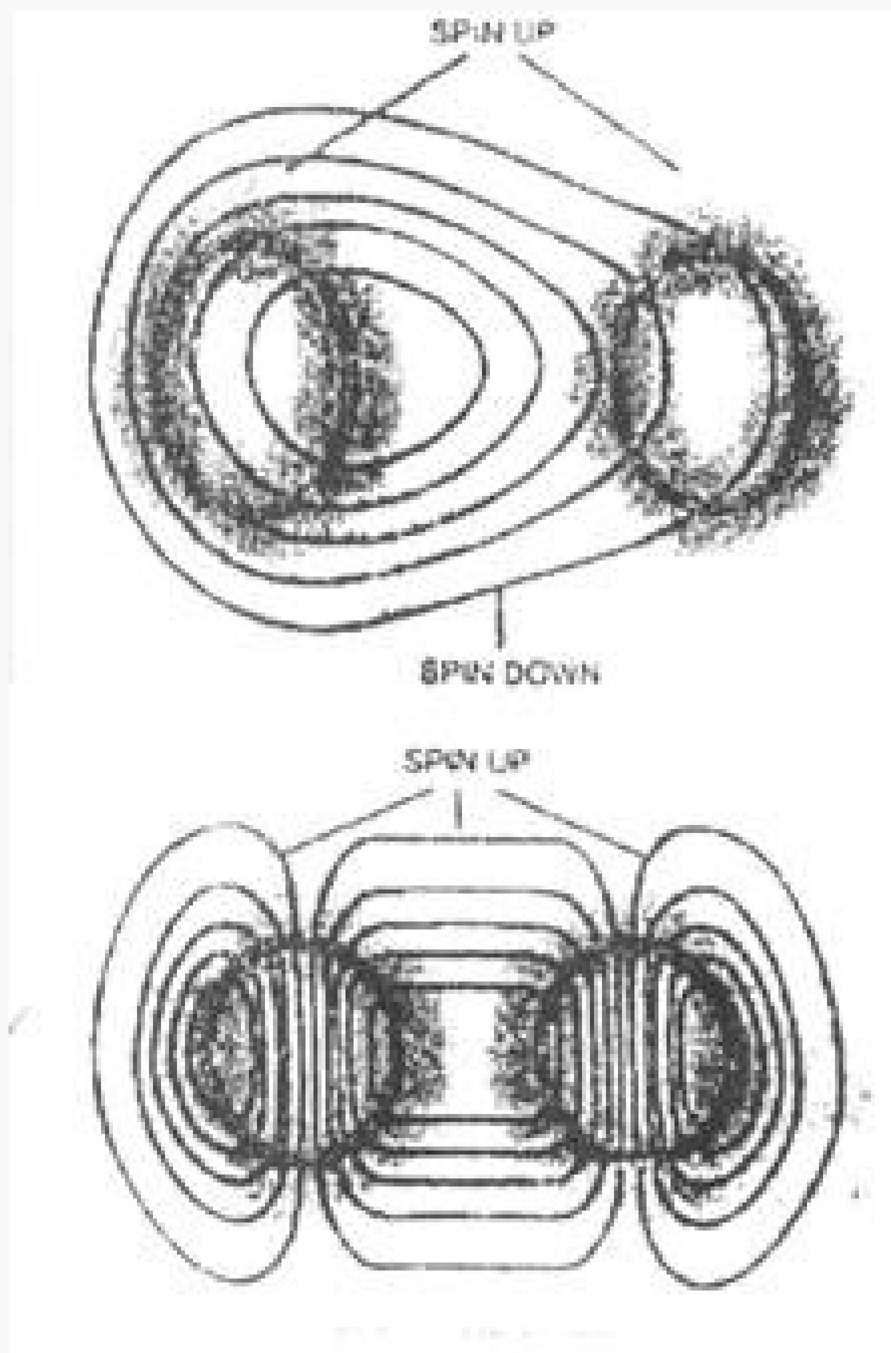
Spintronics can be fairly new term for you but the concept isn't so very exotic .This technological discipline aim to exploit subtle and mind bending esoteric quantum property of electron to develop a new generation of electronics devices.

The ability to exploit spin in semiconductor promise a new logical devices as spin transistor etc with enhanced functionality higher speed and reduction power conception and might have a spark revolution in semiconductor industry. so far the problem of injecting electron with controlled spin direction has held up the realization of such spintronics

Spintronics is an emergent technology that exploits the quantum propensity of the electrons to spin as well as making use of their charge state. The spin itself is manifested as a detectable weak magnetic energy state characterised as "spin up" or "spin down".

Conventional electronic devices rely on the transport of electrical charge carriers - electrons - in a semiconductor such as silicon. Device engineers and physicists are now trying to exploit the spin of the electron rather than its charge.

Spintronic-devices combine the advantages of magnetic materials and semiconductors. They are expected to be non-volatile, versatile, fast and capable of simultaneous data storage and processing, while at the same time consuming less energy. Spintronic-devices are playing an increasingly significant role in high-density data storage, microelectronics, sensors, quantum computing and bio-medical applications, etc.



One of the most inherent advantages of spintronics over electronics is that magnets tend to stay magnetised, which is sparking in the industry an interest for replacing computers' semiconductor-based components with magnetic ones, starting with the random access memory (RAM), Let me tell you an example: You are in the mid of documenting a project presentation that you need to present tomorrow morning and you face an electric power failure. Your UPS was not recharged and, the worst part of all, you didn't save your presentation. I am sure that a condition like this is enough, to leave you back, pulling your hair, for now you have to do the same task right from the scratch.

You need to do all this just because all the information that is stored via electron charges is lost as soon as you face the power failure. And that is why before turning a computer off, you are bound to save your new work to a disk.

Imagine a computer that retains all the information put into it: it's really possible with all-magnetic RAM. Most importantly, there would be no 'boot-up' waiting period when the power is first turned on a great advantage, especially for laptop users.

Another promising feature of spintronics is that it does not require the use of unique and specialised semiconductors, thereby allowing it to work with common metals like copper, alumimum, and silver. So the cost of such devices for you is unlikely to be high even in the beginning. **-----20BF1A0470- H Kaavya**

NANOELECTROMECHANICAL SYSTEMS

Nanoelectromechanical systems, or NEMS, are MEMS scaled to submicron dimensions [1]. In this size regime, it is possible to attain extremely high fundamental frequencies while simultaneously preserving very high mechanical responsivity (small force constants). This powerful combination of attributes translates directly into high force sensitivity, operability at ultralow power, and the ability to induce usable nonlinearity with quite modest control forces. In this overview I shall provide an introduction to NEMS and will outline several of their exciting initial applications. However, a stiff entry fee exists at the threshold to this new domain: new engineering is crucial to realizing the full potential of NEMS. Certain mainstays in the methodology of MEMS will, simply, not scale usefully into the regime of NEMS. The most problematic of issues are the size of the devices compared to their embedding circuitry, their extreme surface-to-volume ratios, and their unconventional "characteristic range of operation". These give rise to some of the principal current challenges in developing NEMS. Most prominent among these are the need for: ultrasensitive, very high bandwidth displacement transducers; an unprecedented control of surface quality and adsorbates; novel modes of efficient actuation at the nanoscale, and precise, robust, and routinely reproducible new approaches to surface and bulk nanomachining. In what follows I shall attempt to survey each of these aspects in turn, but will conclude by describing some exciting prospects in this new field.

PRINCIPAL NEMS ENGINEERING CHALLENGES

Pursuit of Ultrahigh Q. Central to attaining the ultimate limits of VHF/UHF NEMS performance is the pursuit of ultrahigh Q. This overarching theme underlies all research in NEMS, with exception of nonresonant and fluidic applications. Dissipation (~1/Q) within a resonant mechanical element limits its sensitivity to externally applied forces (signals), and sets the level of fluctuations that degrade its spectral purity (i.e. broaden its natural linewidth), and determine the minimum intrinsic power levels at which the device must operate. Hence ultrahigh Q is extremely desirable for low phase noise oscillators and highly selective filters; it also makes external tuning of dissipation easier

Extrinsic and intrinsic mechanisms are operative to limit Q in real devices. Many extrinsic mechanisms can be suppressed by careful engineering; these include air damping, “clamping losses” at supports, and “coupling losses” mediated through the transducers. Some of the intrinsic mechanisms may be suppressed by careful choice of materials, processes, and handling. These include anelastic losses involving: a) defects in the bulk, b) the interfaces, c) fabrication-induced surface damage, and d) adsorbates on the surfaces. Certain anelastic loss mechanisms are, however, fundamental; these impose the ultimate upper bounds to attainable Q's; such processes include thermoelastic damping arising from anharmonic coupling between mechanical modes and the phonon reservoir [10]. Surfaces. NEMS devices patterned from single crystal, ultrapure heterostructures can contain very few (even zero) crystallographic defects and impurities. Hence, the initial hope was that within small enough structures bulk acoustic energy loss processes should be suppressed and ultrahigh Q-factors thereby attained. In this size regime one might even expect bulk dissipation to become sample-specific – i.e. dependen upon the precise configuration and number of defects present.

NEMS offer access to a parameter space for sensing and fundamental measurements that is unprecedented and intriguing. Taking full advantage of it will stretch our collective imagination, as well as our current methods and “mindsets” in micro- and nanodevice science and technology. It seems certain that many new applications will emerge from this new field. Ultimately, the nanomechanical systems outlined here will yield to true nanotechnology. By the latter I envisage reproducible techniques allowing mass-production of devices of arbitrary complexity, that comprise, say, a few million atoms í each of which is placed with atomic precision [38]. Clearly, realizing the “Feynmanesque” dream will take much sustained effort in a host of laboratories. Meanwhile, NEMS, as outlined here, can today provide the crucial scientific and engineering foundation that will underlie this future nanotechnology.

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