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Mechanical Engineering Department

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SJPN, Trust's

Hirasugar Institute of Technology, Nidasoshi

Approved by AICTE, New Delhi and Affiliated to VTU Belagavi- Accredited by NAAC at 'A' Grade & NBA

INSTITUTE VISION

“To be a preferred institution in Engineering Education by achieving excellence in teaching and research and to remain as a source of pride for its commitment to holistic development of individual and society”

INSTITUTE MISSION

"To continuously strive for the overall development of students, educating them in a state-of-the-art-infrastructure, by retaining the best practices, people and inspire them to imbibe real time problem solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals"

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

“To be the centre of excellence in providing education in the field of Mechanical Engineering to produce technically competent and socially responsible engineering graduates”

MISSION

“Educating students to prepare them for professional competencies in the broader areas of the Mechanical Engineering field by inculcating analytical skills, research abilities and encouraging culture of continuous learning for solving real time problems using modern tools”

Program Educational Objectives (PEOs)

The Graduates of the program will be able to

PEO1: Acquire core competence in Applied Science, Mathematics and Mechanical Engineering fundamentals to excel in professional career and higher study.

PEO2: Design, demonstrate and analyze the mechanical systems which are useful to society.

PEO3: Maintain professional and ethical values, employability skills and multidisciplinary approach to realize engineering issues in broader social context by engaging in life-long learning.

INDEX

01.Mixed-mode solar cabinet

Introduction

Drying is one of the methods used to preserve food products for longer periods. The heat from the sun coupled with the wind has been used to dry food for preservation for several thousand years.

Solar thermal technology is rapidly gaining acceptance as an energy-saving measure in agriculture applications. It is preferred to other alternative sources of energy such as wind and shale because it is abundant, inexhaustible, and non–pollution. Solar air heaters are simple devices to heat air by utilization solar energy and it is employed in many applications requiring low to a moderate temperature below 80C, such as crop drying and space heating.

Working

The solar cabinet dryer is based on the greenhouse effect where the solar heat is trapped inside the drying chamber and thus increases the temperature level. The direct solar energy collected in the chamber, heat the food product and remove moisture. The indirect heat energy collected in the solar collector heats the air in the chamber; hence air circulation continuously increases the temperature in the cabinet. This method of continuous air circulation increases the trapped air temperature which in turn increases its efficiency. As the system involve both natural and forced convection, hence called mix mod. When the solar cabinet with all the systems attached to give maximum results the solar tube arrangement is attached to the cabinet the air circulation takes place in a special manner. The tubes increase the temperature of the air which involves heating with direct sunlight. This heated air is forced into the chamber using the fans at the inlet and outlet of the solar tube. These fan movement is controlled by the relay system called as W1209 Digital Temperature Controller. This relay involves triggering the system to operate at a particular set temperature. When we set the temperature of this relay at 35°C the relay will de-energize at that particular temperature. Till that the energy is provided to the exhaust fans and hot air circulation takes place. These relay system and exhaust fans are connected to the 12v battery which in turn is connected to a 10watt solar panel to make it self-sustained. Hence the solar panel is connected to a battery with no voltage controller and this battery is connected to a digital relay. The cabinet is made up of wood with black paint with a back-mounted door with a latch. The cabinet has sub division in it to hold different types of drying trays.

Figure1. Assembled Model

Conclusion

The solar dryer can raise the ambient air temperature to a considerable high value for increasing c drying rate of crops. The product inside the dryer requires fewer attentions, like an attack of the product by rain or pest (both human and animals), compared with those in the open sun drying Although the dryer was used to dry chilly, it can be used to dry other crops like yams, cassava, maize, potato and plantain, etc. There is an ease in monitoring when compared to the natural sun drying technique. The capital cost involved in the construction of a solar dryer 15much lower than that of a mechanical dryer

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02. Ceramic Disc Brakes

Introduction

One of the most important control systems of an automobile is the brake system.They are required to stop the vehicle within the smallest possible distance and are done by converting the kinetic energy of the vehicle into heat energy which is dissipated into the atmosphere. The brakes must be strong enough to stop the vehicle within the minimum possible distance in an emergency. But this should also be consistent with safety. The driver must have proper control over the vehicle during emergency braking and the vehicle must not skid. The brakes must have good antifade characteristics and their effectiveness should not decrease with the constant prolonged application.

Porsche ceramic disc brakes (PCCB)

After a long period of research and tests, Porsche has developed new high-performance disc brakes, PCCB. Porsche has succeeded as the first car manufacturer in the world to develop ceramic brake discs with involute cooling ducts for efficient cooling. Porsche's new brake system also offers obvious advantages in emergencies at low speeds: In such a case emergency application of the brakes with PCCB technology does not require substantial pedal forces or any technical assistance serving to build up maximum brake forces within fractions of a second. Instead, the Porsche Ceramic Composite Brake ensures maximum deceleration from the start without requiring any particular pressure on the brake pedal. And the new brake system is just as superior in its response under wet conditions since the new brake linings cannot absorb water in the same way as conventional linings. The final point, of course, is that the cross-drilled brake discs help to optimize the response of the brakes also in wet weather.

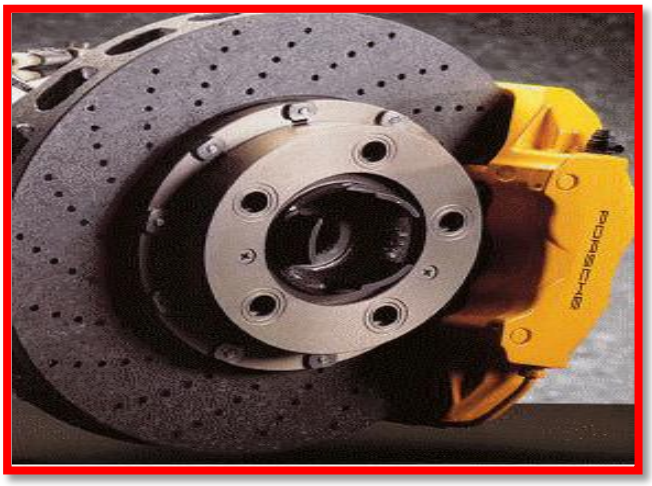

Figure 2.1. Porsche ceramic composite brake

Application

It was first introduced in Formula One, but applying to road cars seems impractical (F1 cars have a warm-up lap to bring the discs into appropriate working temperature), although the short-lived French sports car specialists Venturi made history by applying it to its road cars in the mid-90s Porsche's fastest production model, the 911 Turbo, with a top speed of 305 km/h (189 mph) and acceleration from rest to 100 km/h (62 mph) in 4.2 s. Its engine is a 3.6-L producing 309 kW (420 hp), with maximum torque of 560 N•m (413 lb•ft) available from 2700 rpm is available with new Porsche Ceramic Composite Brake System.

Figure 2.2. PORSCHE 911 TURBO

Conclusion

Ceramic brake discs due to their advantages over conventional brake discs are going to be the brake discs for cars in the future. The special combination in the ceramic brake discs had turned the conventional brake disc into a material most suited for making brake discs. With the success of this in Porsche turbo cars, many other racing cars and commercial vehicles are going to implement the ceramic disc in their cars.

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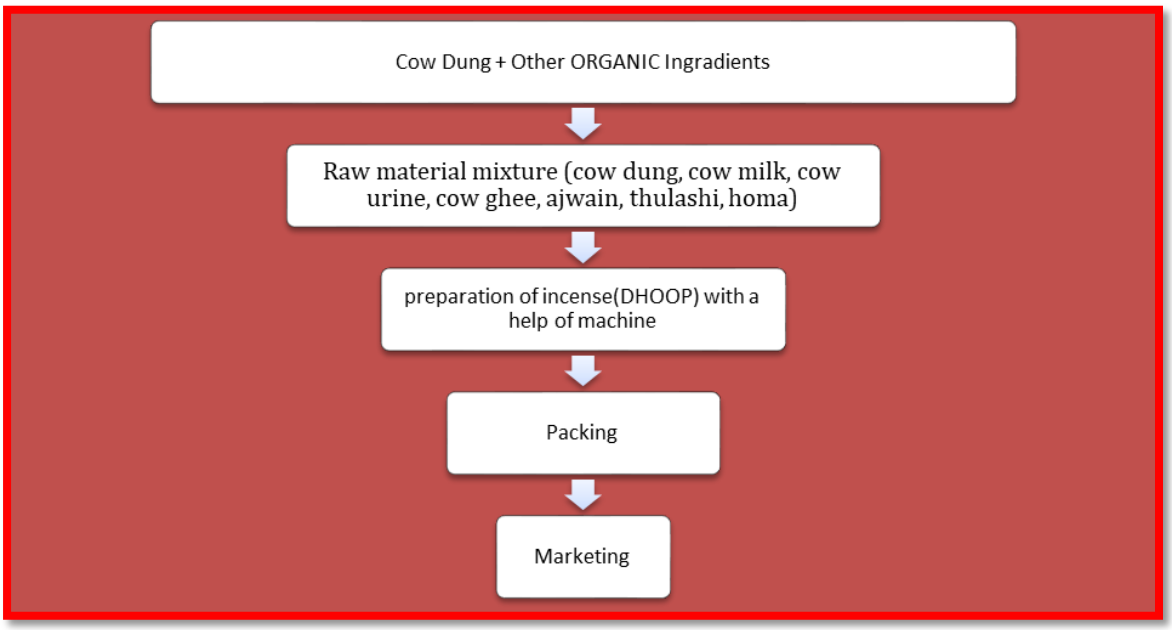
03. Small Scale Unit to Manufacture Organic Incenses

Introduction

The environment has been a major concern in today's era. The constant pollution all-around has gathered the attention of many people. A clean environment that includes clean air, water, land and energy, is essential for human existence. The formulation was developed using natural agents like cow dung, clarified butter, cow milk and certain herbs which are known traditionally for their fragrances. Cow dung has been used since time immemorial as a source of disinfection in different households. In various religious practices such as homa/ havans, cow dung, cow ghee, cow urine, camphor, etc have been used to cleanse the environment and feel pleasant. With the help of this traditional knowledge, we tried to devise a method to prepare a DHOOP stick having pharmacopoeia quality using various cow products and plant powders for cleansing the air.

Methodology/Working



1. Collection of ingredients from the local market and to check the quality and then used for the preparation of DHOOP.
2. Cow dung was procured from local Gowshala, the cow dung was then pulverized in a domestic grinder and sieved to obtain the fine powder.
3. All the ingredients are mixed with cow dung.
4. Preparation of DHOOP with the help of DHOOP making machine.
5. Using heater DHOOP sticks are dried at 500C of temperature.

6. DHOOP sticks are packed in paper bags, installing the unit and commercializing the product

Figure1. Fabricated Model

Conclusion

The current work focuses on the preparation and evaluation of natural and herbal dhoop formulations for cleansing the environment. From the above results, it is evident that this Ddhoop. Can cleanse the environment and can be a potential and efficacious source of disinfection in various areas. Thus instead of using chemical sources and the harmful UV rays for disinfection in hospitals. etc, this herbal dhoop having defined quality and which is prepared from well accessible and affordable sources can be used. The current work can be extended to areas like schools, colleges, hospitals, public lavatories. etc. It can also help in creating a positive environment and can act as a room purifier and air freshener.

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04. Pedal Operated Washing Machine

Introduction

A washing machine is a device that imparts mechanical energy by rotating the clothes in a top/front-loaded washing machine. This project covers one of the daily house-hold activities such as washing clothes. People wash clothes either by hand or use power-driven washing machines. This is a very strenuous, time-consuming and expensive process.

Working

The basic principle of operation of a “human-operated washing machine” is that when a sufficient amount of power is applied using cycling through a chain drive to the conventional rotating drum mechanism, then the inner drum revolves in a clockwise direction. The centrifugal force of the rotating inner drum and inside plastic rib is responsible for the rotation of washing clothes. For conventional electronic washing machines, electricity is required to get the work done. The same type of arrangements of flow is made in a human energized washing machine. For 40-50 rpm, the clothes were served was slow but the texture of the cloths (less wrinkle) was fine enough. The washing rate was found to be 30 minutes per 3-5Kgs & the average time that subject can maintain the pedaling is 20 minutes. For 70-80 rpm, the washing rate of cloths was observed to be maximum & also the cloths washed were somewhat wrinkled. Further, it was found difficult to maintain this pedaling rate for more than 5 minutes. When input pedaling rate is set to 50-70 rpm 3-5Kgs of cloths requires 20 minutes. To get the required fineness double watering was required but not to the extent as that requiring at higher pedaling rate. So overall for 3-5 Kg requires 20-25 minutes and this pedaling rate is found more comfortable than the other two.

Figure 4.1 Assembled model

Conclusion

As far as the manual process is concerned in remote areas in India washing is done by hand scrubbing which is straining to the muscles through its energy. Many of their household chores are performed by the women and some can be very physically challenging and timeconsuming. Nowadays women's duties are neglected by technological improvement efforts because domestic chores are often seen as cultural obligations for women. So little effort is expended to diminish them and women are often considered less technically competent than men. Factors like these tend to prevent the development of improved technology for women's uncompensated, time-consuming and laborious tasks. At urban places, people prefer available power-driven washing machines to wash and rinse their clothes. In India, most of village or urban are suffering from a shortage of electricity so powered washing machines becomes almost impractical. To overcome all these problems, this project intends to solve the problem faced by so many persons in their day-to-day life, by concentrating on the washing machine, which is operated manually. It required no power supply or any fuel supply. This project uses inexpensive parts that are easily available, very low repairing and maintenance cost, affordability to each member of the society, does not affect the environment and is made up of a simple cycle pedaling mechanism to run the washing machine shaft, its innovation lies in its simple design. This Design is very useful in the daily life of households, ergonomically efficient, easy to operate and easy to pedal by women or children and also very useful for body fitness for youngsters and wards those who are staying in hostels for their undergraduate and post graduate degrees. This project costs estimation approximately Rs.7000 to Rs.8000 in batch production. For better performance in the future, this project may install with multiple gear mechanisms.

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05. Digital Manufacturing

As there are more automated tools in the manufacturing industry, it is the duty of the industry to model, run the simulation and analyze the machines, input materials and tooling. The name indicates that the manufacturing is controlled through numbers or numerals in the digital form i.e. write the G codes and M codes in a program and that can be operated through a central computer.

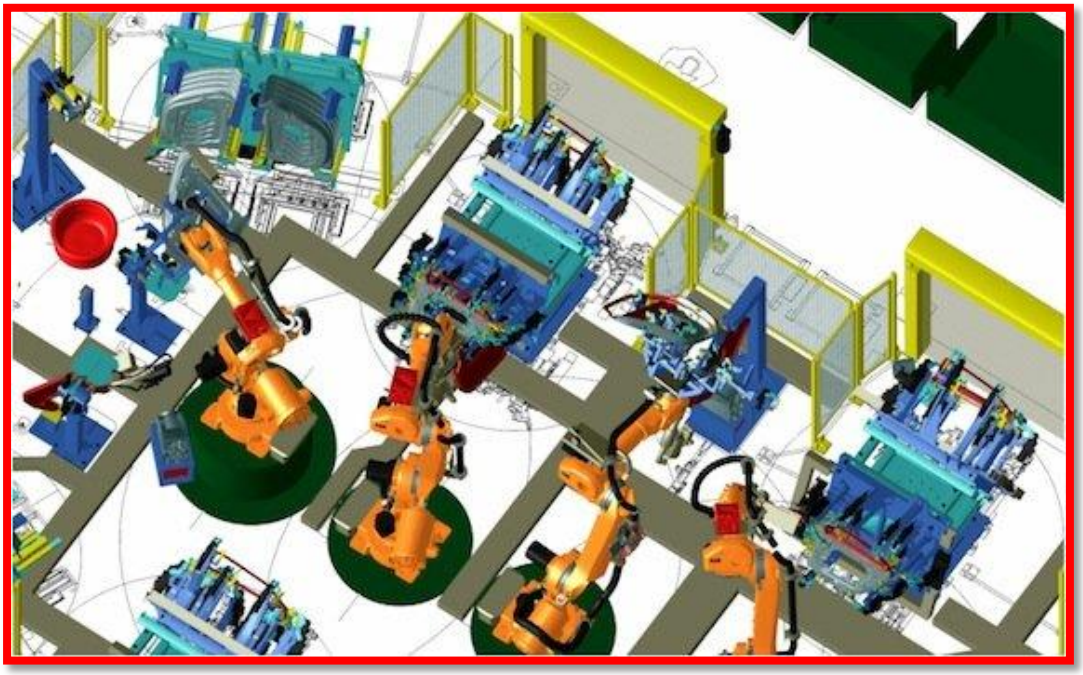

Figure 5.1 Digital Manufacturing

By Bridge land Copyright, Robotic simulation using Rob cad software for virtual manufacturing. To meet the market demand, there will be a need for a large number of goods to the consumers. By making a few things or goods does not sustain the environment, therefore there is the need for Digital Manufacturing. With the rise in the quality and quantity of computer systems in manufacturing plants, the transition to digital manufacturing has become popular. As you can see that the digital manufacturing would be sharing the same goals

- Flexible Manufacturing
- Lean Manufacturing
- Computer Integrated Manufacturing
- Design for Manufacturing

6. Industry 4.0

Industry 4.0 is one of the trends of Mechanical Engineering which focuses on Data exchange and Automation in manufacturing technologies and processes which include the Internet of Things (IOT), artificial intelligence, Cloud computing, Industrial Internet of Things (IIOT).

"Industry 4.0" factories have machines that have sensors and other parts with wireless connectivity that can visualize the entire production line and make the decisions on its own.

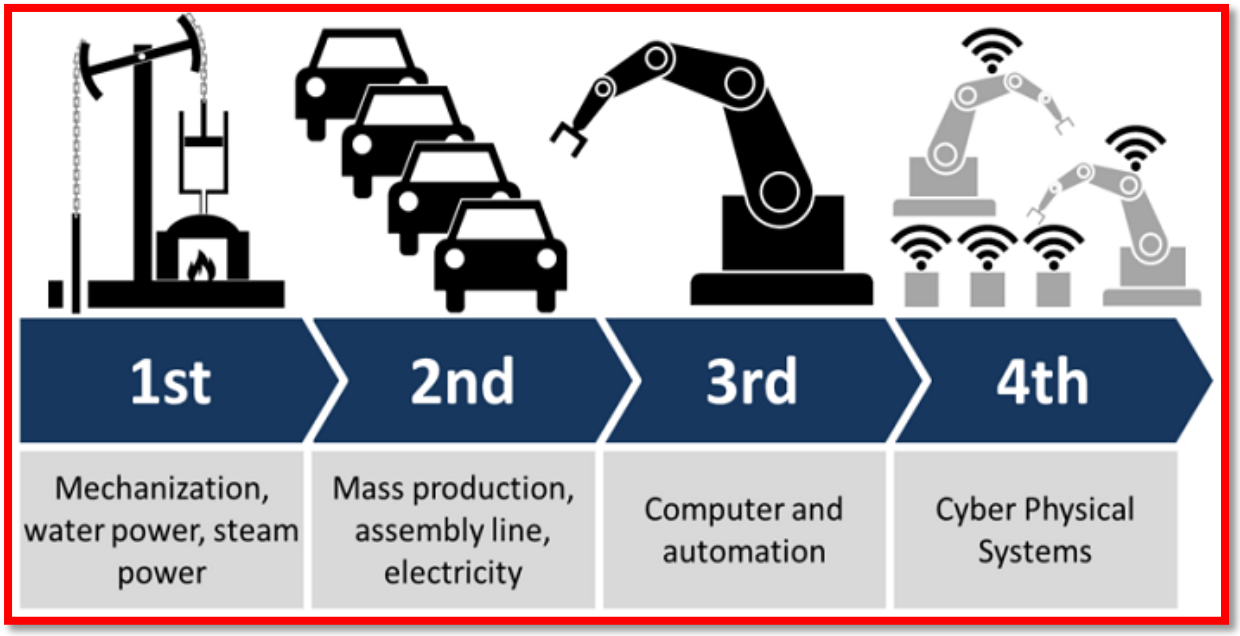

Figure 6.1 By Christoph Roser at Allaboutlean.com, Illustration of Industry 4.0, showing the four "industrial revolutions" with a brief English description

The Components of Industry 4.0 includes

- Smart factory
- Internet of Things for manufacturing
- Smart Manufacturing
- Dark factories also known as Lights out Manufacturing
- 3D printing
- Big data analytics and advanced algorithms
- Data visualization

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7. Nano Technology

It is defined as the manipulation of matter with at least one dimension sized from 1-100nm. Nanotechnology defined by its size is very broad, including fields of science such as

- Surface Science
- Molecular Biology
- Micro fabrication
- Molecular Engineering
- Organic Chemistry
- Semiconductor Physics
- Energy storage

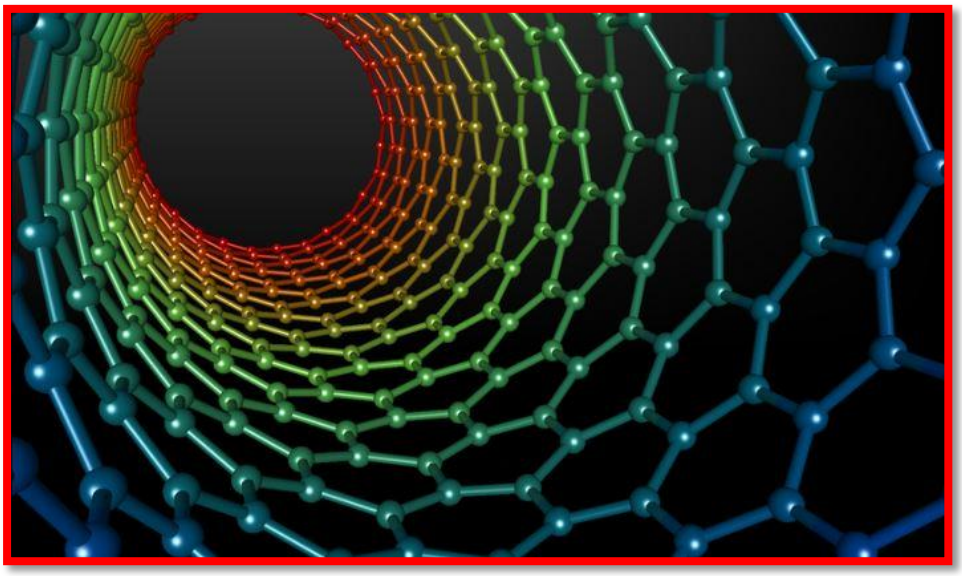

Figure 7.1 By Mstroeck, Single-walled Carbon Nanotube, consisting of a graphite sheet wrapped into a cylinder shape.

The current research is based on the following areas

- Nanomaterials
- Top-down approaches
- Bottom-up approaches
- Functional approaches
- Speculative
- Bio mimetic approaches
- Dimensionality in nonmaterial's

8. Autonomy Everywhere

Artificial intelligence is likely to define the coming decade. It has already begun to increase its footprint in engineering software, where generative design applications automatically optimize CAD designs to best fit the functional definition of a part—including how it will be manufactured. There is more to come. Software vendors are also developing AI systems to advise engineers on materials selection and compliance. Meanwhile, robotic process automation (RPA) software enables bots to blast through such clerical engineering chores as auditing change orders, managing bills of materials and searching for opportunities to standardize parts among multiple products.

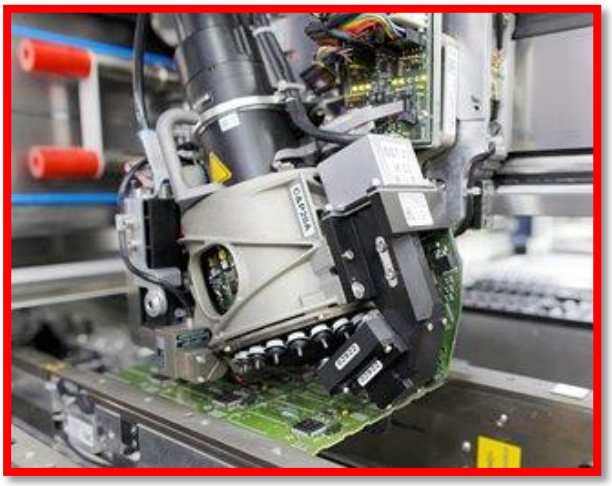

Figure 8.1 At a Siemens factory, systems automatically test circuit boards while central computers analyze the data to see if machines are likely to stray from specifications. Photo: Siemens

AI shows up increasingly in autonomous systems. These include vehicles and drones, as well as robots that route parts in factories and warehouses (and which may one day replace conveyor belts), and robots that deliver drugs and supplies in hospitals. AI makes possible a vast range of sophisticated products that respond autonomously to their environment or spoken commands. Over the next decade, AI will get smarter, faster, and far more accurate. But first, it must overcome an imposing barrier: trust. It will take most of the decade before anyone trusts a highway full of autonomous cars or a multimillion-dollar factory that makes its own decisions without human backup.

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9. Rashmi: Hindi Speaking Humanoid Robot

Introduction

This robot was launched on 1 August 2018, 2 years after the start of its development. Its development started as a hobby when Shrivastava's son challenged him after seeing Rajnikant's Robot Movie to make something like that. Ranjit started to work on it after son's challenge without having any technical team or research lab. After its launch, most of the media covered its news nationally as well as globally.

Rashmi is the world's first Hindi speaking and India's first realistic lip-syncing humanoid robot which can speak four languages – English, Hindi, Bhojpuri and Marathi – developed by Ranjit Shrivastava, a 38-year-old programmer from Ranchi. Rashmi uses a linguistic interpretation system, artificial intelligence and visual data to interact with people. This Indian robot, Rashmi was build in two years of time and has earned positive remarks from many experts such as Dr. Somnath Chattopadhyaya, Associate Professor of IIT-Indian School of Mines. The robot has many features besides lip-syncing. Rashmi gives facial, lips, eyes and eyebrow expressions. She can move her neck. Russia Today reports that the robot believes in god and has a spiritual side.

The robot has many features other than lip-syncing. It gives facial, eye, lips, and eyebrow expressions and it can also move its neck with its 6-axis neck movement. It can show 83 facial expressions. As I told Rashmi can speak four languages - English, Hindi, Marathi and Bhojpuri. that's why would is now looking towards Ranjit from Ranchi.India.

Rashmi works on four layers including Linguistic Interpretation, APIs (Application Programming Interfaces) and and AI (Artificial Intelligence) through which It interprets emotions of conversat ion also. It has a camera built-in her eyes with facial recognition, 3D Mapping and OCR through which she can work in the kitchen one day. She has also a functional hand with finger movement. Rashmi does not have legs at present.

Figure 9.1 Beautiful Rashmi Robot

As a guest in engineering colleges Artificial Intelligence

Rashmi was invited to IIT, Delhi in December 2018. Later Rashmi was invited to many engineering colleges as the guest of honor or chief guest including Government Engineering College, Amravati, College of Engineering, Pune, Veermata Jijabai Technological Institute Mumbai, IIITDM Kanchieeuram and Don Bosco College of Engineering, Mumbai.

ISRO approached Rashmi

Indian Space Research Organisation (ISRO) approached Ranchi-based engineer Ranjeet Srivastava, who developed the world's first multilingual social humanoid, Rashmi, to use it for India's first manned mission in space, called Gaganyaan, in 2022. Two ISRO scientists had met Srivastava and Rashmi in Ranchi with a list of questions and asked Srivastava to develop the existing robot with certain simulated features resembling human physiology.

Rashmi vs. Sophia

It was claimed that Rashmi is more advanced in functionality than the Sophia, humanoid robot from Hanson Robotics as Rashmi can talk in four languages while Sophia interacts in English only

Hats off to Ranjit Shrivastava who proved technology can prove anything

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10. Regenerative Braking

Introduction

Regenerative braking is an energy recovery mechanism that slows down a moving vehicle or object by converting its kinetic energy into a form that can be either used immediately or stored until needed. In this mechanism, the electric traction motor uses the vehicle's momentum to recover energy that would otherwise be lost to the brake discs as heat. This contrasts with conventional braking systems, where the excess kinetic energy is converted to unwanted and wasted heat due to friction in the brakes, or with dynamic brakes, where the energy is recovered by using electric motors as generators but is immediately dissipated as heat in resistors. In addition to improving the overall efficiency of the vehicle, regeneration can significantly extend the life of the braking system as the mechanical parts will not wear out very quickly.

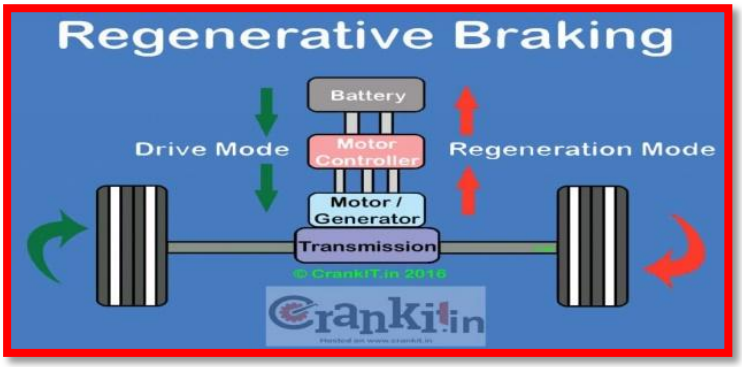

Figure 9.1 Regenerative braking

Working of the regenerative braking system

In the regenerative braking system, the motor, which drives an electric vehicle, also performs the function of braking. The system consists of an electric motor with a dual function. It works as a motor in one direction and also as a generator in the opposite direction. When it runs as a motor, it converts electrical energy into mechanical energy and drives the wheels. However, while braking, it runs in the opposite direction and becomes an electric generator. Applying the brakes of an electric or hybrid vehicle causes the electric motor to run in reverse direction i.e. in generator mode. Thereby, it slows down the wheels. During this time, the wheels transfer the kinetic energy or momentum back to the generator. While rotating, the generator converts this kinetic energy into electrical energy. Later, it transfers the electricity generated back to the batteries and charges them.

Advantages

1. A part of the energy is returned to the supply system, so energy consumption for the run is considerably (about 20 to 30 percent) reduced thereby affecting a considerable saving in the operating cost.
2. The wear of the brake shoes and wheel tyres is reduced to a considerable extent, therefore, their life is increased and replacement cost is reduced.
3. Higher value of braking retardation is obtained so that the vehicle can be brought to rest quickly and running time is considerably reduced.
4. Small amount of brake dust is produced when the mechanical brakes are applied.
5. Higher speeds are possible while going down the gradients because the high braking retardation can be obtained with regenerative braking.
6. Propulsion of heavier trains on gradients is possible without dividing them into sections with speed and safety.

Disadvantages

1. Additional equipment is required for control of regeneration and protection of equipment and machines, hence initial as well as the maintenance cost is increased.
2. The dc machines required in the case of regenerative braking are of large size and cost more than those ordinarily employed, therefore, the weight of the locomotive and thus the required mechanical strength and cost increase.
3. Owing to recuperated energy the operation of the substations becomes complicated and difficult.

Applications

1. Hybrid and Electric Cars
2. Auto Racing

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11. Low-Cost Eco Carrier Bag Making Machine

Introduction

Plastic considered as one of the greatest inventions by its use in carrying things has become a major element in polluting the environment. Plastic bags remain in the soil for centuries, degrading the soil, preventing it from replenishing its nutrients, and rendering to barren. In the current situation, the use of plastic bags for every single work has become a usual thing. Right from buying grocery from the market to shopping in malls everywhere plastic bag is been used. The use of plastic bags across the country has increased, and it is continuously increasing day by day. Eco cloth bags, on the other hand, are bio-degradable and hence highly environment friendly than plastic bags. Throughout India people make paper carry bags by hand in their homes as per the local demand. The use of eco cloth bags is promoted nowadays.

Working

The pre-folded cloth is inserted into the machine till the end manually then the machine is started and initially the heated coil and facing tool which is heated around 90°C fuses the cloth bag at one end then with the help of rolling mechanism of pulleys the cloth is moved forward the part of the fuse is moved till the cutting mechanism as the blade is at the middle of folk fusion alliance that ensures that each bag is fused from one side that bifurcates between two bags similarly as the future part from fusing again come to the blade part blade cuts the middle at the fusing similarly in middle at 4 lines of fusing that makes one complete bag as to fusing at the start and to fusing at the end that makes the complete rectangle bag. The material comes in through the pulleys and stops at the base plate of the fusing mechanism where fusing takes place. Then the material moves forward and stops where cutting action takes place. The process continues until the machine is stopped. The material stops at a particular area because of a timing delay provided for motors.

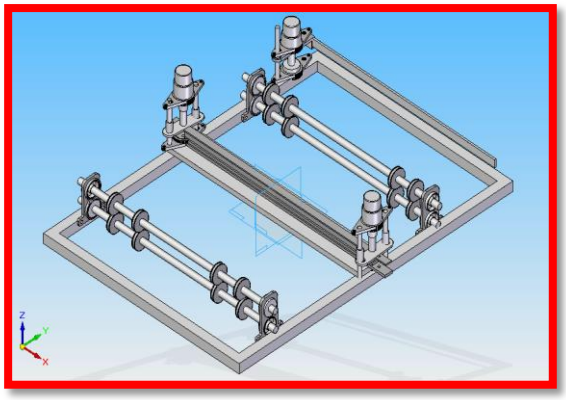

Figure10.1 3D model low-cost eco carrier bag making machine

Advantages

- A bag is available at a low cost
- Low power consumption
- Capital investment is low
- variable sizes of bags
- Simple construction

Disadvantages

- A manual loading cloth is required
- The cloth must be free folded before feeding
- To vary the bag size the program to be changed

Application

1. This machine can be used for the mass production of Cloth bags.
2. These bags can be used for domestic purpose in shops and markets

Conclusion

1. This machine converts cloth into a cloth bag with the help of an eco cloth bag making machine**.**
2. We can reduce the plastic used.
3. The machine is cheaper and portable than the currently available cloth bag manufacturing unit
4. We design a cloth bag machine that produces cloth bags that will not only ecofriendly and degradable but also will have a high load-carrying capacity, and nice aesthetics

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12. Rapid Prototyping for Industrial Product Development

Introduction

Machining is a subtractive process, beginning with a solid piece of stock. The machinist must carefully remove the material until the desired geometry is achieved. For complex part geometries, this is an exhaustive, time-consuming, and expensive process. Some parts are even too complex to be machined. Rapid Prototyping is a method in which the part is created by a layer-additive process. Using specialized software, a 3-D CAD model is cut into very thin layers or cross-sections. Then, depending on the specific method used, the RP machine constructs the part layer by layer until a solid replica of the CAD model is generated. Material selection is also method specific.

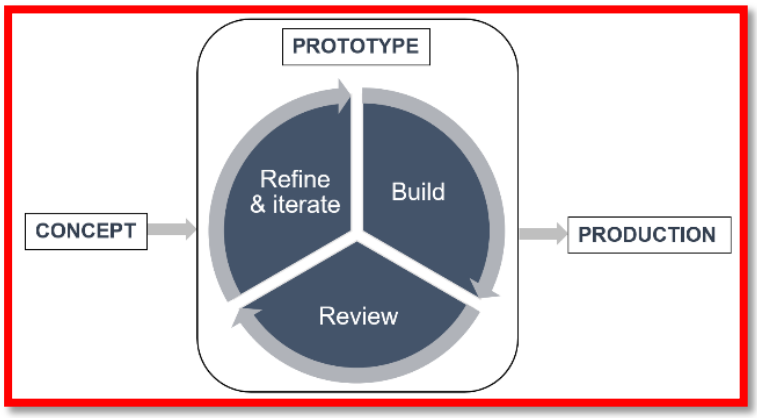


Figure 11.1: An overview of rapid prototyping

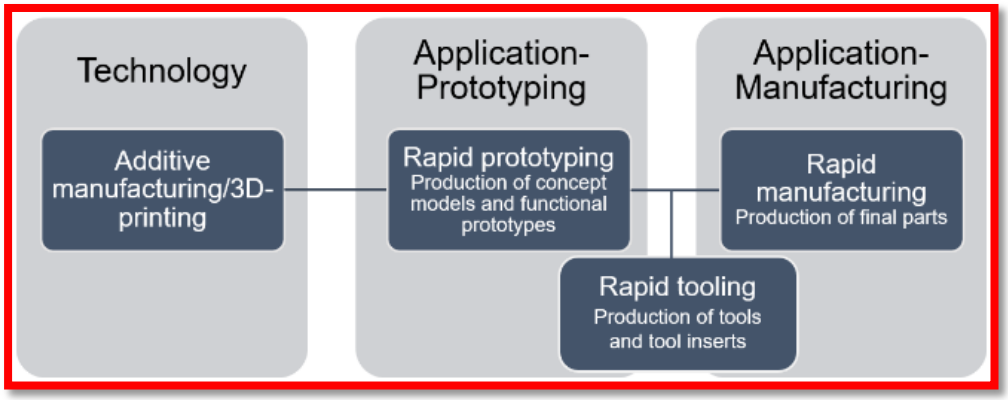
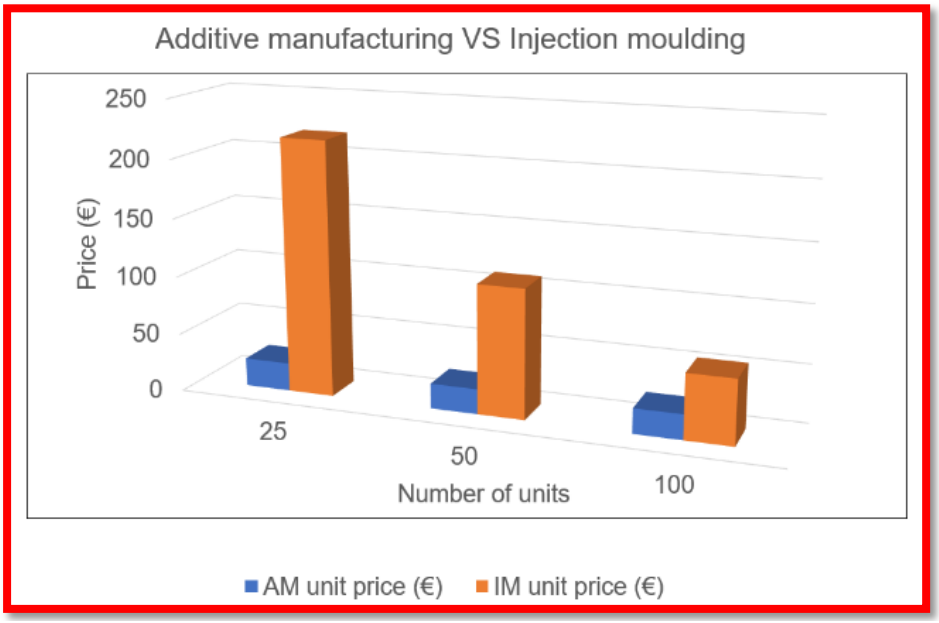


Figure 11.2: Additive manufacturing/3D printing and its subcategories

Rapid prototyping, as the name implicates, is referred to different techniques used to quickly and economically produce a model of a product or part of an assembly by using additive manufacturing. Since the 1990's the term rapid prototyping is associated with additive manufacturing technique. Today rapid prototyping is described as a subset of additive

manufacturing that deals with the production of prototypes. Additive manufacturing or most commonly named 3D printing is an additive process of depositing material layer by layer to produce a 3D model of the product or component of an assembly. The traditional manufacturing techniques like injection molding and CNC need expensive tooling and setup, which makes low-volume production of prototypes highly expensive. One of the biggest advantages of rapid prototyping over traditional manufacturing methods is that rapid prototyping does not require any special tooling to make the model. For the same reason, the rapid prototyping method is benefited compared to the traditional method in terms of time, energy, money, and material saved. Rapid prototyping has its limitation in the maximum achievable size of the model and lacks the features like creating many moving parts that interlocks and work together like in traditional methods. Based on few case studies concluded that additive manufacturing compared to injection molding is economically beneficial when considering the production of parts below 500 units (depending on size) and for producing complex objects. The graph shows that rapid prototyping is economically beneficial over traditional manufacturing when low volume production like prototyping is considered.



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13. SLM 3D Printer

Introduction

SLM printer uses selective laser melting technology which melts metal powders and solidifies layer by layer until a three-dimensional part is built. During the process, the ruler in the build chamber will pave one layer of the metal powder, a high powered laser selectively fuses the powder by tracing cross-section of the part on the surface of a powder bed and then a new coat of material is applied for the next layer. The whole process is in a high vacuum chamber or full of a protective gas chamber to avoid the metal powder reacts with oxygen at a high temperature

Z-Rapid is using high energy and fine spot laser, the equipment can complete complex parts in a very short period while using conventional methods that will take several weeks or even months to complete in comparison. Parts not only have precise dimension, high tensile and high density but also excellent mechanical properties. Mainly used for rapid production of high precision, high-quality metal parts.

•Fiber laser

• Fast galvanometer

• SLM Control System

FEATURES: High speed, High precision, High quality

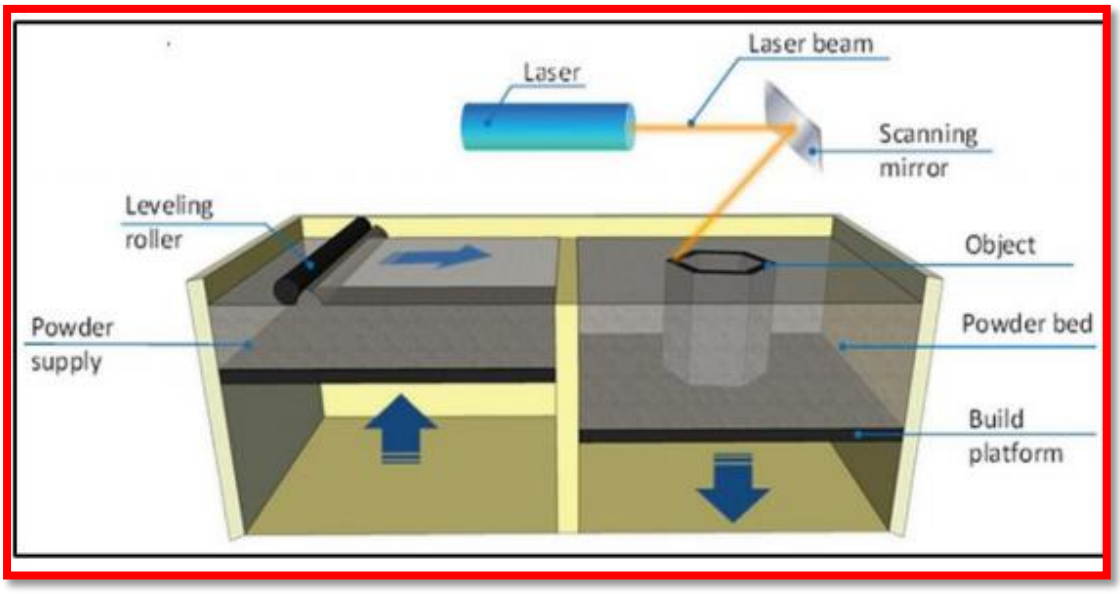

Figure 12.1 Schematic diagram of SLM 3D printing technology

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14. Importance of Mechanical Engineering

Mechanical engineering is a diverse subject that derives its breadth from the need To design and manufacture everything from small individual parts and devices (e.g., micro scale sensors and inkjet printer nozzles) to large systems (e.g., space craft and machine tools). The Role of a mechanical engineer is to take a product from an idea to the market place. Mechanical Engineering deals with anything that moves, including the human body, a very complex machine. Mechanical engineers learn about materials, solid and fluid mechanics, thermodynamics, heat transfer, control, instrumentation, design, and manufacturing to understand mechanical systems. Specialized mechanical engineering subjects include biomechanics, cartilage-tissue engineering, energy conversion, laser-assisted materials processing, combustion, MEMS, micro fluidic devices, fracture mechanics, nano mechanics, mechanisms, micro power generation.

It is stated, **"**Mechanical engineering is at the forefront of developing new technologies for several industries including transport, healthcare, construction, and robotics. What an exciting time to be alive and what an exciting time to be a mechanical engineer.**"** (the complete university guide). Mechanical Engineers are people who research and carry out projects to help society lives more comfortably and effectively. They develop machines, which most of them are very close to the lives of the people, like gadgets from smart phones and tablets, to big machines like cars and factory machines. Not only that, they even are a part of the development for the newest updates on the iPhone 6S and Samsung Galaxy S7. Though the job of a mechanical engineer isn't opening publically, the importance of them and the influence that they give to society is very critical. For example, the invention of the television resulted in people being more aware of the big events going around in society, but at the same time, it got people addicted and ruined the lives of families. Though some might argue that mechanical engineers are giving society a very negative influence, the pros out way the cons. Also, the bad that comes out of it mostly has to do with the impulsions and the personal desires of the human kind. The job of mechanical engineering is the 'frontline-fleet', fighting for the development of society and the progression of technology in the lives of the people.

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15. Plug-and-Play World

Today, technologies like AI, IOT, big data, 5G, autonomous robots, and block chain are stand-alone solutions. It is no small task to ensure a variety of IOT sensors can speak with a manufacturing execution system, which is, in turn, able to talk with a cloud-based data analytics package. That leaves producers with two choices: They can either find a vendor who packages all these capabilities together, though this may lock them into a single and often expensive proprietary system. Or, if they want to mix and match best-of-class applications, they must pay programmers to integrate devices and software, so data formats are compatible up and down the system.

Figure 14.1 Students emerge from a Local Motors Ollie bus. The company used 3D printing and AI software to find a niche in the market for campus transportation. Photo: Local Motors

This is going to change, and large engineering and manufacturing software companies are preparing for it. We are seeing a push towards greater standardization, increased interoperability, and faster deployments. These changes will bring down costs for larger companies to create systems that span their entire enterprise—and make it possible for smaller firms with fewer resources to deploy the full range of Industry 4.0 technologies.

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Semester: III

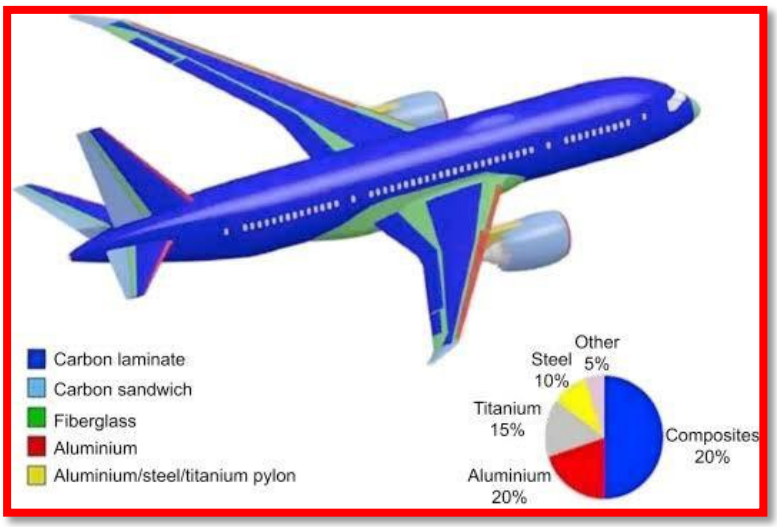
16. Advanced Composite Materials of the Future in Aerospace Industry

Introduction

A composite material is a material that consists of strong carry-load materials that are embedded in a somewhat weaker material. The stronger material is commonly referred to as reinforcement and the weaker material is commonly referred to as the matrix. There is a revolution underway in commercial aircraft manufacturing today and it can be summed up in one word: *composites*. There are many good reasons for aircraft manufacturers to use composites. Many composite materials achieve relatively greater strength characteristics compared with traditional metallic materials, reducing aircraft weight and thus reducing fuel cost per passenger carried. Composites are more resistant than metal to fatigue from repeated take off/landing cycles.

The future of composites in the aerospace industry

With the increasing fuel costs and environmental lobbying, commercial flying is under sustained pressure to improve performance, and weight reduction is a key factor in the equation. Beyond the day-to-day operating costs, the aircraft maintenance programs can be simplified by component count reduction and corrosion reduction. The competitive nature of the aircraft construction business ensures that any opportunity to reduce operating costs is explored and exploited wherever possible. A composite material is made when two or more different materials are combined to create superior and unique materials. The demand for lighter and more efficient aircraft will ensure that there are considerable opportunities in aerospace for composite parts manufacturers.



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17. Industrial 5G for the Industry of Tomorrow

Overview

Industries 4.0, the smart factory, the industrial internet of things (IIoT) - these are the future of industrial manufacturing. Designing production plants and intralogistics to be more flexible, autonomous and efficient requires the right communication framework and comprehensive connectivity standard opens up important prospects.

Digital Connectivity with 5G – Where's the journey heading?

Is 5G ready for the industry? Is the industry ready for 5G? What are the use cases for 5G? And what about the benefits for your business? We are going to know about these and many more questions around "Digital connectivity with 5G" and where the journey is heading!

Industrial 5G

Before the green light for the smart factory can be given, new concepts and technologies are required – from production to intralogistics and transportation. There is already talk of applications such as mobile robots in production, autonomous vehicles in the transportation and logistics sectors, IIoT, augmented reality applications for service and maintenance technicians, and virtual reality applications for users. But all these applications place demands that would quickly push today's networks to their limits. The unprecedented reliability, extremely low latencies, and comprehensive IIoT connectivity of industrial 5G can clear the way for pioneering applications in the industrial environment. In its search for long-term, sustainable communication solutions, some market-leading companies are now investigating the terrain for industrial 5G and actively supporting the development and technical implementation of the new standard.

Figure17.1 Automotive Test Centre From Siemens

Industrial 5G The first private test network for industry

From a vision to reality: At the company's Automotive Showroom and Test center in Nuremberg, Germany, Siemens is setting another milestone on the path to Industrial 5G. In collaboration with Qualcomm Technologies, Inc., the first private standalone 5G networks have been set up in an industrial environment and are running in the test operation.

Industrial 5G.Testing the future

Expectations are running high for the potential of 5G wireless communication for industrial applications. To test its feasibility, a proof of concept for Industrial 5G has been set up at the Siemens Automotive Showroom and Testcenter. The private 5G installation uses the 3.7 to 3.8 GHz 5G frequency band. Here comprehensive tests are being carried out in a real industrial environment to thoroughly test the performance of Industrial 5G. The Industrial 5G test network is being used to test concrete industrial applications with 5G, such as the operation of automated guided vehicles (AGVs) for smart production, logistics and highly flexible manufacturing. Whether it's the reliability of wireless communication, its real-time behavior, or its safety in interactions between humans and machines, all aspects are being rigorously tested at the Nuremberg Test Center under actual industrial conditions. The 5G test installation was implemented in collaboration with Qualcomm Technologies, Inc., a company with which Siemens has been collaborating in the area of wireless communication technologies for many years.

Industrial 5G. A look behind the scenes

There's a lot that's worth knowing about a new communication standard like Industrial 5G. Here you'll learn interesting facts – for example, about the development that started in 1979 with 1G and is now progressing to 5G.

Outlook

Industrial 5G raises a lot of questions, everyone aware of that. And because we know that, some companies maintain a separate research team devoted to this topic. Experts are hard at work on the new communication standard and its implementation in the industrial and manufacturing environment.

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18. Nanomotors

Nanotube and Nanowire Motors

The two-micron long nanomotors were composed of two segments, platinum and gold, that could catalytically react with diluted hydrogen peroxide in water to produce motion. The Au-Pt nanomotors have an autonomous, non-Brownian motion that stems from the propulsion via catalytic generation of chemical gradients. As implied, their motion does not require the presence of an external magnetic, electric, or optical field to guide their motion. By creating their local fields, these motors are said to move through self-electrophoresis. Joseph Wang in 2008 was able to dramatically enhance the motion of Au-Pt catalytic nanomotors by incorporating carbon nanotubes into the platinum segment.

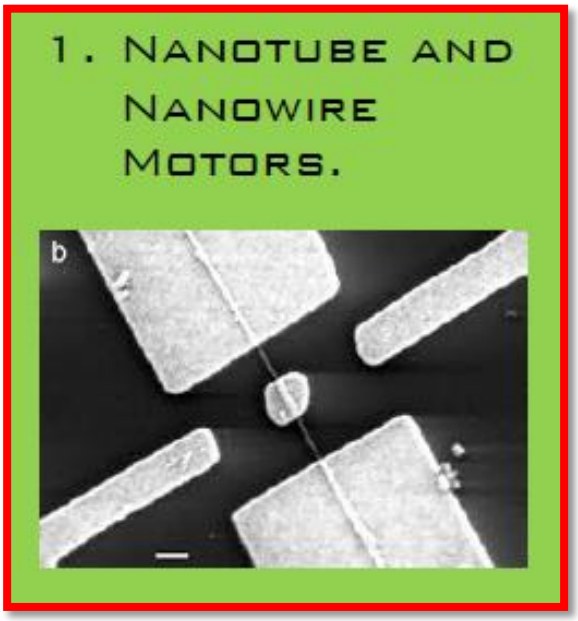

Figure 18.1 Nanotube and Nanowire Motors

Enzymatic Nanomotors

Recently, there has been more research into developing enzymatic nanomotors and micropumps. At low Reynold's numbers, single-molecule enzymes could act as autonomous nanomotors. Ayusman Sen and Samudra Sengupta demonstrated how self-powered micropumps can enhance particle transportation. This proof-of-concept system demonstrates that enzymes can be successfully utilized as an "engine" in nanomotors and micropumps. It has since been shown that particles themselves will diffuse faster when coated with active enzyme molecules in a solution of their substrate.

Figure 18.2 Enzymatic Nanomotors

Helical Nanomotors

Another interesting direction of research has led to the creation of helical silica particles coated with magnetic materials that can be maneuvered using a rotating magnetic field. Such nanomotors are not dependent on chemical reactions to fuel the propulsion. A triaxial Helmholtz coil can provide a directed rotating field in space. Recent works have shown how such nanomotors can be used to measure the viscosity of non-Newtonian fluids at a resolution of a few microns. This technology promises the creation of a viscosity map inside cells and the extracellular milieu. Such nanomotors have been demonstrated to move in blood. Recently, researchers have managed to controllably move such nanomotors inside cancer cells allowing them to trace out patterns inside a cell. Nanomotors moving through the tumor microenvironment have demonstrated the presence of sialic acid in the cancer-secreted extracellular matrix.

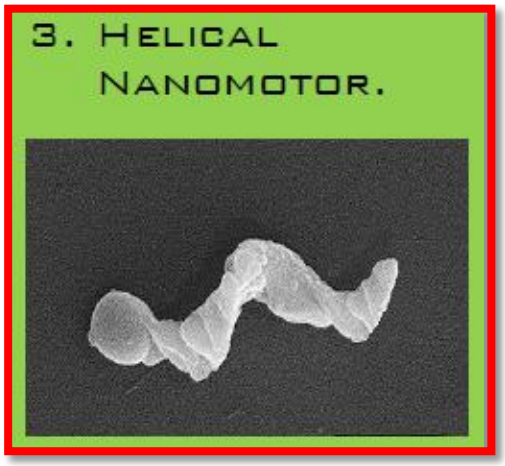

Figure 18.3 Helical Nanomotors

19. Bonic Eyes

To heal the blinds

Visual impairment is one of the diseases that, once not cured immediately, can turn to total blindness. The report said 20% chances that any therapy or medicine could not treat visual impairment. For those who are blind now, stem cell therapy is a common solution. But not anymore. Daily Mail UK reported on Wednesday, Sept. 15, researchers from Monash University have developed a device that could cure human blindness. Through the headgear they developed that applies the Gennaris bionic vision system, scientists prepare to do the 'bionic eye' experiment on a human subject. This is the first time in the world that scientists develop a brain chip device that targets to cure the blindness of a person.

How it works

Vision processor unit and software, and a set of 9x9 millimeter tiles that are implanted into the brain. Here's how it works: the attached camera in the device will capture the user's environment or surroundings. Once it's done, the camera will send the images to the vision processor, where the technology extracts data from the transmission. It will then flow to the complex circuitry in each of the implants-- that was first put inside the person's brain-- and is converted into a pattern of electrical pulses that stimulates the brain using microelectrodes. "Our design creates a visual pattern from combinations of up to 172 spots of light (phosphenes) which provides information for the individual to navigate indoor and outdoor environments, and recognize the presence of people and objects around them," Arthur Lowery, professor at Monash University's Department of Electrical and Computer Systems Engineering, said in a statement. Scientists are not only seeking a cure for blindness, but they also want to find a treatment for untreatable neurological conditions, such as limb paralysis, to be able to function using the same device.

For more details refer

https://youtube.be/CLUWDLKAF1M

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20. Touch less Doorbell

The project is based on a object detecting using a IR sensor. An IR sensor is a consists of an IR LED and photodiode. Together they are called as Photo - Coupler or Opto-Coupler. Touch less door bell is consist of IR LED, photo diode, resistors, potentiometer, general LED with a buzzer, etc. Such a way that whenever the any object comes close to the IR sensor, the buzzer starts beeping and the LED glows. This concept of touch less door bell is very useful as a fire engines, Railroad crossing, School bells and Alarm in industrial plants etc. This system is suitable for securing door.

Following the needed components are:

1. Resistors
2. Potentiometer/variable resistor
3. IR transmitter
4. IR receiver
5. Normal LED
5. Connecting wires
7. Battery/DC source
8. Buzzer

Advantages:

1. The house owner can open the door very quickly
2. It is very helpful for short people
3. Save time for searching doorbell switch
4. Save electricity

Disadvantages:

1. It is very expensive.
2. If the any components is damage then it is does not work.

Applications:

1. Fire engines
2. Railroad crossing
3. School bells
4. Alarm in industrial plants etc.

Mr. Akshay Boragalli

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Program Educational Objectives (PEOs)

The Graduates will be able to

PEO1: Acquire core competence in Applied Science, Mathematics and Mechanical Engineering fundamentals to excel in professional career and higher study

PEO2: Design, demonstrate and analyze the mechanical systems which are useful to society.

PEO3: Maintain professional & ethical values, employability skills, multidisciplinary approach & an ability to realize engineering issues to broader social context by engaging in lifelong learning.

Program Specific Outcomes (PSOs)

PSO1: Able to apply the basic principles of Mechanical Engineering in various practical fields to solve societal problems by engaging themselves in many state/national level projects.

PSO2: Able to analyze and design basic mechanical system using relevant tools and techniques.

PSO3: Able to resolve contemporary issues of industries through industry institute interaction and alumni social networks

Program Outcomes (POs)

PO1: **Engineering knowledge-** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **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.

PO3: **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.

PO4: **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.

PO5: **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.

PO6: **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.

PO7: **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.

PO8: **Ethics-** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work-** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **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.

PO11: **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.

PO12: **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.

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