Yaantrika

Department of Mechanical Engineering

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Vision

Vision and Mission of the Institute

To be one of the premier Institute of Engineering and Management education in the country.

Mission

To provide Engineering and Management education that meets the needs of human resources in the Country.

To develop leadership qualities, team spirit and concern for environment in students.

Vision and Mission of the Department

Vision

To be a premier department for education in Mechanical engineering in Karnataka state, that moulds students into professional Engineers.

Mission

To provide a teaching-learning process that prepares engineers to meet the needs of industry and higher learning.

Provide environment for self learning to meet the challenges of changing technology and inculcate team spirit and leadership qualities to succeed in professional career.

To instill professional ethics and concern for environment for the benefit of society.

"Yaantrika" from The Department of Mechanical Engineering, is dedicated to Late Dr. A.P.J. Abdul Kalam - "The People's President".

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B.N.M Institute of Technology

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From Editor's Desk

Dear Readers,

Welcome to the November 2015 issue of our newsletter Yaantrika.

The team of Yaantrika, likes to give our readers, the most unusually arresting and intellectually stimulating newsletter. The newsletter endeavors to reflect the values and the quality of our Institution. The presentation of the entire newsletter shows the creative indulgence of our students. A lot of thought and care has gone into the making of the newsletter.
We would like to express my appreciation to all those who have contributed articles in this issue. It is this willingness to make the effort to share knowledge, concerns and special insights that have made this issue possible.

Knowledge is treasure which appreciates when we share and depreciates when accumulated. Never stop sharing knowledge and helping others

About ME Department

Department of Mechanical Engineering started in the Year 2011-2012with an intake of 60 students and the department offers undergraduate program in Mechanical Engineering and is headed by Dr. Mukesh Patil. All the laboratories have been established procuring state of the art equipments. The department has a team of talented and well qualified staff members, with a blend of industrial and academic experience. Faculty members with Master's and Doctorate degree qualification having specialization in Machine Design, Thermal engineering, Product Design and Maintenance Engineering are rendering their service to academics.

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3D Printing: Future of Manufacturing

Since industrial revolution manufacturing has been synonymous with factories, machine tools, assembly lines and supply chains. Manufacturing without these is unimaginable. Manufacturing in this age is about witness a huge revolution. Do we call it modern manufacturing. Does it include a huge factory floor, massive inventories and extensive labor? The answer is simple no!

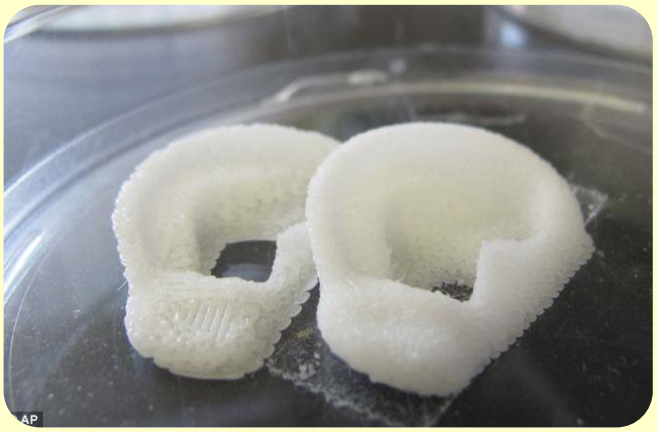
3D printing is the answer which will disrupt the traditional manufacturing. Traditional manufacturing focused on material removal as a primary means of machining while 3D printing focuses on material deposition or addition, hence the name additive manufacturing. a good analogy is how quantum physics challenged classical physics.

Didn't 3D printing exist before? Why wasn't it used earlier? Why is gaining traction with the enthusiastic researchers now? The reason for all this boom is the patents concerning the 3D printing expired in late 2012, which means the classified works of patent which was available only to those who honored the patents and paid the requisite royalty, became available to public domain. By the time the inventors realized the potential of 3D printing and were working their way to get around patents they understood that the patents were about to expire. The inventors made a patient wait and watch and it has paid off.

3D printing, it is a factory without a factory floor giving rise to a new generation of DIY (do it yourself) manufacturers.3D printing aka additive manufacturing (am), refers to various processes used to synthesize a 3D object. In 3D printing, successive layers of material are formed under computer control 3D printing is a classical disruption; 3D printing can also be called the 3rd industrial revolution. It reaches out to small businesses, individuals and corporate offices. Parts can be manufactured at home or workplace by clicking "print" and watch the physical object take shape.3D printing changes the game of traditional manufacturing by optimizing batch size to just one.

Prototyping new products is the largest commercial application of 3D printing today, it is estimated to be 70 percent of the 3D printing market. Prototyping gives designers a way to test products as concepts or functional objects early in the design cycle.

Boeing, pioneer in 3D printing has printed 22000 components that are used in aircrafts. NASA's next space exploration vehicle (rover) includes about 70 percent 3D–printed parts. The most inspiring use of



3D printing is in the healthcare industry, where it has the potential to save lives and dramatically improve them using a patient's own cultured cells or stem cells, the wake forest institute for regenerative medicine has developed a 3D printing technique for engineering tissue and organs. The ultimate goal is to help solve the shortage of donated organs available for transplant. Scientists are working on a variety of projects including ear, muscle and a long-term effort to print a human kidney

Shreyas R & Vijay Sai, VII sem

Bio-mimicry

Humans are clever, but without intending to, we have created massive sustainability problems for future generations. For instance our manufacturing approaches; we remove material from a large stock to give it a desired shape and size. A bottom down approach in which, a lot of material is just wasted. On the contrary, nature manufactures from bottom up, like we construct buildings although material is wasted there as well. Copying nature is the solution to all our sustainability issues. This copying is called as Bio-mimicry. The core idea is that nature has already solved many problems we face. After billions of years of R&D, failures are fossils, and what surrounds us is the secret to survival. As Steve jobs said "I think the biggest innovations of the 21st century will be at the intersection of biology and technology. A new era is beginning." inclusion of biology in engineering curriculum will give today's engineering professionals another tool to make sustainable engineering. It is high time we adopt this in more of our practices or else we too can turn fossils some day.

Rajat Nandan, VII sem

Materials with Negative Poisson's Ratios

When a material is uni-axially loaded in tension, it extends in the direction of the applied load, in which extension is accompanied by a lateral deformation. The lateral deformations are quantified by a property known as the Poisson's ratio. In mathematical terms it is defined as the negative ratio of the transverse and longitudinal strains. In particular, for stretching in the x direction, the Poisson's ratio in the x-y plane of the material is defined by:

$$\nu_{xy} = -\frac{\varepsilon_y}{\varepsilon_x}$$

Although traditionally, the Poisson's ratio was always assumed to be positive since most everyday materials get thinner when stretched, today, it has been shown through numerous studies that negative Poisson's ratio materials exist, meaning that referring to figure for the x-y plane, a uni-axial load in the x-direction results in an extension in the y-direction. the existence of these materials confirms what had been predicted by theory for a long time: the theory of elasticity states that the Poisson's ratio for three dimensional isotropic materials may range between $-1 \leq \nu \leq +0.5$ while for two dimensional isotropic materials, it may range between $-1 \leq \nu \leq +1$, with no upper or lower bounds for anisotropic materials. Several terms have been coined to describe these counterintuitive materials including auxetic, 'anti-rubber', dilational and 'self-expanding',

Palash Malani, VII sem

Bionics

Bionics is the application of biological methods and systems found in nature to the study and design of engineering systems and modern technology. It can also be stated that bionics is a term which refers to the flow of concepts from biology to engineering and vice versa.

The transfer of technology between life forms and manufactured product is, according to proponents of bionic technology, desirable because evolutionary pressure typically forces living organisms, including fauna and flora, to become highly optimized and efficient. A classical example is the development of dirt- and water-repellent paint (coating) from the observation that the surface of the lotus flower plant is practically non-sticky for anything. Examples of bionics in engineering include the hulls of boats imitating the thick skin of dolphins; sonar, radar, and medical ultrasound imaging imitating the echolocation of bats. The technology used here is the implanted myo-electric sensor (imes). When the electrical impulse from the brain reaches the base of the leg, pair of sensors embedded in the muscle tissue connect the neural dots, and wirelessly transmit that signal to the proprio foot (a prosthetic with a motorized, battery-powered ankle). Since the command reaches the foot before the wearer's residual muscles actually contract, there's no unnatural lag between intention and action. The surgery to implant sensors is minimal. As the procedure takes 15 minutes, and each sensor require a single-centimeter-long incision. The tiny sensors (3 millimeters-by-80 millimeters) are powered by magnetic coils embedded in the socket -- the cushioned, hollow component that fits over a user's residual limb, and connects to the prosthesis. Since there are no integrated batteries to deal with, there's no need to replace the sensors (unless they fail for other reasons). A thing that differentiates the mind- controlled prosthesis is its simplicity. The sensors, which are used, need not have to be attached to specific nerves. That also means that tissue doesn't have to be harvested from other, more nerve-dense parts of the subject's body. The prosthesis moves based on which sensor—the front or rear—picks up an impulse in local muscle tissue. If the user moves his calf muscles, the robotic foot follows suit. One major advantage of sensor-control is the way it redistributes your weight.

Pratheek H B, VII sem

SHREDDETRON 6000

Leaf shredder you would want to use!

One common sight in our cities is leaves being shed continuously and around the year. These leaves once collected by the civic authorities are either burnt or sent to dumping grounds where they either become a part of a land fill and pollute the environment or just discarded. Another problem is that once these leaves are burnt they cause pollution and lead to the emission of harmful carcinogenic fumes which are harmful to everyone and can lead to cancer, asthma and other respiratory problems.

One solution to this is shredding leaves to a small size and converting them into very rich manure which can later on be sold commercially. This would lead to proper handling of leaves, ensuring we get the maximum out of something that we usually think of as waste or garbage.

Taking this concept into heart we have made shreddertron 6000, an economical and practical leaf, paper and plastic shredder that can be used anywhere and everywhere.

shreddertron 6000 consists of 3 main parts which are the housing, the motor and cutting system. Coming to the motor, we use a 600w single phase motor rated at a speed of 16,000 rpm. The motor has a speed controller that can vary the speed of the motor depending on the type of application and the load of leaves being fed into the system.

The motor is held in place using a clamping system that holds the motor to the frame securely using heavy duty fasteners. The motor shaft is connected to the cutting system by the help of a mild steel shaft held in place by a vertical Plummer block. Coming to the cutting system we make use of high strength poly-carbonates wires. This system has many advantages over a traditional solid blade. One of the main advantages is that, these wires are stable at high revolutions as there are very little vibrations induced due to imbalance of weight. Another problem that poly-carbonates wires take care of is easy replicability and inexpensiveness when compared to a perfectly balanced metal blade. Now thinking of the applications of such a system in a whole, we get quite a few ideas. This range from shredding leaves in parks, gardens, residential complexes such as apartments, localities and individual home owners. These shred leaves can be used to make compost or can be used as a source to retain moisture over the soil. With modifications to the cutting blade (introduction of a metal blade with specific blade profile and angle) and introduction of a centrifuge system this can be used for threshing rice, corn, ragi, and other crops. Again with modifications to the cutting system (metal blades with thicker and sharper edges) we can even use to effectively cut and shred organic waste that is being generated from our localities and cities. Another application is its use in industries such as sericulture where leaves and cocoons of silk worms have to be shred to a very small size before extraction. It can also be used to shred plastic and paper (below a certain thickness) leading to easier transportation, effective recycling and less overall garbage. With modifications to the cutting system and power delivered by the motor it can used in multitude of fields and for varying and distinct applications.

Prajwal Rao, Skanda Bhagavath,

Vijeth V, Varun Kumar, V sem

Automated Car Parking System

Lack of space availability has always been a problem in urban areas and major cities and to add to it there are cars parked callously on the streets that further limit the space. In order to handle the issue of parking in busy places various types of vehicle parking systems are used worldwide namely Multi-level Automated Car Parking, Automated Car Parking System, Volkswagen Car Parking and many more. The present project work is aimed to develop a reduced working model of a car parking system. It is an amalgamation of the already developed parking systems with the added advantage of reduced space occupancy by the design of a simpler and compact parking system that occupies vertical parking space. The platform is fabricated to suit the working model. By testing and analyzing the working model we can definitely get the view to develop the parking lots at difficult and busy commercial places.

Advantages

- Accommodates more number of vehicles in compact space.
- Reduces parking time.
- Reduces pollution as drivers need not circle around in search of empty parking space.
- It reduces the human stress.
- Eliminates labor as it is automated.
- There is no need for an energy intensive ventilating system, since vehicles are not driven inside.
- It offers less building cost per parking slot since less floor space is required to accommodate more vehicles, even though the initial cost of the machine is high.
- Accidents are prevented inside the parking space since it is automated and is controlled by a computer.

Limitations

- Frequent maintenance of the machines are required.
- The subjective analysis has shown that the greatest effects of a multi-storey car park on surrounding residential blocks are the air and noise pollution caused by the motor vehicles.
- Parking lots also tend to be subject to contamination with concentrated spots of pollutants such as motor oil.
- Power back up is required since the entire system is automated and requires electrical power.
- Many areas today also require minimum landscaping in parking lots. This usually principally means the planting of trees to provide shade.

Conclusion

Automatic car parking is one of the important factors in traffic areas, multiplexes, apartments, educational institutions, etc; Car parking system that is discussed here is automated without human being interference that means if the driver leaves the vehicle at the starting of this system the movable platform takes the car to the parking slot.

Automated car parking is very useful in this modern world where finding a small place have become a big problem and parking the vehicle by the side of the road results in traffic congestion and traffic jams.

Harshith R., Indrakumar C.M, Karthik Y, Kashyap N. Pandit, III sem

Momenta and Forces

How did it all begin?

All through the course of human history, there has always been a constant struggle between human beings and Mother Nature in the quest for survival. Perhaps the first attempt ever made formally in understanding the physical world all around, was to study "motion". There was a need to explain motion both qualitatively and quantitatively and motion was first quantified by the byzantine philosopher, John Philoponus, who developed the concept of momentum in his commentary to Aristotle's physics working in Alexandria in about 530 AD. However, the modern understanding of the concept of momentum was developed by the English mathematician John Wallis in his work, "Mechanica Sive de Motu", "Tractatus Geometricus" in 1670 and Newton had a similar approach in formulating a mathematical model for momentum, which he published in his most famous work "Philosophiæ Naturalis Principia Mathematica" first published in 1687.

What is momentum?

Newton defined a term quantitas motus, "quantity of motion", as "arising from the velocity and quantity of matter conjointly", which identifies it as momentum. In his second law of motion, when he refers to mutatio motus, "change of motion", being proportional to the force applied, it is understood as momentum being changed and not just motion being changed. In other words, if a force is applied on a particle for a short period of time δt, it creates an impulsive effect and the particle's quantitas motus (momentum) has incremented by a certain amount:

$$\delta p = f.\delta t$$

Why momentum is mv? Why not something else?

Newton concluded that the quantitas motus to be the "rectangle" of the measure of inertia and velocity (direction accompanied) or simply the product of inertia and velocity. Momentum is not the same as velocity because velocity itself is not enough to define the quantitas motus.

Vocabulary used in physics may not have precise meanings in day to day use but have precise meanings only in physics. Momentum is one such example and it must be defined precisely.

If a certain push is exerted by arms on an object that is light, it moves easily; if the exerted push is just as a hard on another object that is much heavier in the usual sense, then it moves less rapidly. Actually, the words "light" and "heavy" should be replaced with less massive and more massive because there is a difference to be understood between the weight of an object and its inertia. The term "mass" is used as a quantitative measure of inertia. Every object has a certain quantity of mass associated with it just by the virtue of being present. The momentum of an object is the product of two parts: its mass and its velocity. Thus Newton's second law maybe stated mathematically as:

$$f = d(mv)/dt$$

In order to understand the consequences of the law as stated above, we use many intuitive ideas, implications and assumptions are at first combined approximately into our "law".

Later revisited to study in greater detail to imply exactly what every term means. One of the "Newton's approximation" which assert that the mass is constant. Then there are some implications concerning the "force". It can be more accurately defined as there is the law. It is important to realize that this relationship not only involves change in the magnitude of momentum and velocity but also a change in direction. If the mass is considered constant, then law becomes:

$$f = m * dv/dt = ma$$

The acceleration 'a' is the rate of change of the velocity, and Newton's second law says more than that the effect of a given force varies inversely as the mass; it also says that the direction of the change in the velocity and the direction of the force are the same. The velocity of a moving object can change by speeding up, slowing down or even by changing its direction of motion.

This can be better understood if an object moving in a circle of radius r with a certain speed v is considered. In this case, centripetal force (as seen from an inertial frame outside the object) acting at right angles to the velocity of the object causes the circular motion. thus if the object has to be put into circular motion of radius r at a certain velocity v, the required centripetal force can be found out using the equation:

$$fc = mv^2/r \quad \text{(along the radius)}$$

The "force"! And a few parting thoughts… in the scientific community of the modern day, the notion of "shut up and calculate" has become too prevalent. Scientific temperament has been merely reduced to mathematical jargon and technical terminologies.

Although it is just interesting and worthwhile to study the physical laws simply because they help us to understand and to use nature, one ought to stop every once in a while and think,

"what do they really mean?" the meaning of any statement is a subject that has interested and troubled philosophers from time immemorial, and the meaning of physical laws is even more interesting because it is generally believed that these laws represent some kind of real knowledge. the meaning of knowledge is a deep problem in philosophy, and it is always important to ask, "what does it mean?"

so we may ask, "what is the meaning of the physical laws of Newton, which is represented mathematically as f = ma?" at first sight, the answer might sound simple: "if a body is accelerating, then there is a force acting on it!" however, the real content of Newton's laws is this: that the force is supposed to have an independent character, in addition to the law f = ma; but the specific independent properties that the force has were not completely described by Newton or by anybody else, and therefore the physical law f = ma is an incomplete law.

To understand this character of a "force", it is appropriate to illustrate through examples. To begin with, consider the drag on an airplane flying through the air. What is the law of that force? The air rushes all around airplane and its motion is quite complex. It does not seem to be a simple law! On the other hand, it is a remarkable fact that the drag force on an airplane is approximately a constant times the square of the velocity, or $f = cv^2$. This law is not analogous to f = ma because this law is empirical and is obtained roughly by tests in a wind tunnel. This law is the result of enormous complexity and is not fundamentally simple. If we continue to study this law more accurately, we end up going closer and closer towards reality. Similarly, all the forces in nature have their own characteristics. They are the consequences of a prevailing material condition: for example, electrostatic forces occur due to occurrence of charges, gravity due to occurrence of mass, friction due to molecular forces, etc. thus for our convenience, forces have been classified into four groups based on their characteristics viz. electromagnetic, gravitational, strong and weak nuclear forces, each obeying their own form of empirical laws.

To sum it up, the understanding of dynamics plays a pivotal role in the life of an engineer or a scientist. As stated earlier, the discovery of dynamics changed the course of human history. It revolutionized modern industries during the era of the industrial revolution. This essay was an attempt to provide a greater insight about two concepts that are often encountered in the study engineering dynamics: momentum and the "force"!

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Praful V, V sem

Food for thought

The pinball inside the solid wooden cage is quite a bit bigger than the holes. How did it get in?

First, get a pinball or other solid sphere. Now, get a block of wood. Now drill a hole 80% the diameter of the ball in each side of the cube of wood.

Soak your wood block in water for 24 hours. Now the wood will be soft enough to stuff the ball through the hole. The ball will pop in, and when the wood dries, nobody will be able to figure it out.