MECHON

Volume II
Issue 2

VIBRANT tcet MECH ENGINEERS

DEPARTMENT OF
MECHANICAL ENGINEERING

Message by Dean

I am proud to announce the release of 'MECHON' magazine's third issue. The magazine signifies the writers' penmanship and allows them to share their ideas. I acknowledge the efforts taken by the students and staff of Mechanical Department who have taken the initiative to promote the writing and publishing skills of students. This helps the students to share and express their ideas in an articulate manner.

Achievements of students have also been mentioned, which will be a motivational factor for other students to achieve the standard of excellence. I am glad to say that we have achieved our aim of turning this into reality. I would like to congratulate the students, teachers, alumni and everyone else involved in bringing out its third edition. I wish everyone loads of success and a bright future.

Dr. R. R. Sedamkar

Message by Mentor Dean

I feel honored to be a part of the third issue of the e-magazine of the Department of Mechanical Engineering. This is one of the newest departments of Thakur College of Engineering and Technology. Its first batch passed out in 2016. Students have shown tremendous potential not only in academics but also in co-curricular and extra-curricular activities.

At the International conference, faculties and students published technical papers in International journals. Some of the papers were also published in Tata McGraw Hill Publication.

For the overall personality development of students, apart from academics, participation in co-curricular and extra-curricular activities is the need of the hour. Students are encouraged to participate in inter-college and intra-college competitions. All these activities help them in getting jobs in reputed companies. It also helps them to get admitted in institutions of high repute for higher studies in India and abroad.

I commend all faculties, students and staff members for their hard work in publishing the e-magazine, which represents the insights of the Mechanical Department. I wish them best of luck!

Dr. Sanjay Kumar

Message by Head of Department

I am pleased to know that our students succeeded in bringing the third issue of 'MECHON' for this academic year 2017-18. 'MECHON', the departmental magazine has the prime objective of providing aspiring engineers a wide platform to showcase their technical knowledge and to pen down innovative ideas.

This magazine is intended to bring out the hidden literary talents in the students and teachers to inculcate strong technical skills among them. I congratulate and thank all the students and faculty coordinators who have made untiring efforts to bring out this magazine. I wish them all the very best for releasing more such magazines in the future.

Dr. Siddesh Siddapa

Message from Faculty In-charge

It gives me immense pleasure to present the third issue of 'MECHON' magazine of the Department of Mechanical Engineering. It is the talent and outlook of our students which is reflected through this magazine. This is one of the best platforms for our students to present multifaceted personalities and innovative ideas.

I take this opportunity to thank our respected Principal Dr. B. K. Mishra, Dean Academics Dr. R. R. Sedamkar, Dean Mentor Dr. Sanjay Kumar, HOD Dr. Siddesh Siddappa and all the faculty members for their incessant inspiration and kind support. I believe that this edition will prove to be a success. I express my heartfelt gratitude to the editorial committee for their relentless efforts, the young writers for their valuable articles and all those who have been a part of 'MECHON'.

Mr. Pawan Tiwari

Message From Industry Advisor

It was my honour to be a part of the advisory committee of Thakur College Of Engineering Technology and provide some industrial inputs for the curriculum.

My advise the students will be to get some hands-on experience after the end of each semester.

The college should facilitate them and their respective faculty to be part of an association so as to meet some experienced people from the industry.

Students should work on projects related to design and inspection which aren't burdensome so that they can benefit from this experience at the time of placements.
I would request that the college includes a couple of recently graduated alumni in the advisory committee so that they can collectively get more ideas for modifications in the curriculum.

I hope that my inputs were feasible and could be incorporated in the curriculum.
Thanks once again for inviting to be a part of the advisory committee.

Mrs Ruma Rao
Director
Palm Alloy Steels Pvt. Ltd

Faculty Articles

Human Designers in the face of Artificial Intelligence?

-By Jason D'Mello

The Premise

"In the past couple of years, we have experienced such an explosion of computing power that we can completely change the design equation," says Autodesk chief technology officer Jeff Kowalski. Conventionally, a designer's vision is expressed and analysed using a software. Autodesk aspires to use that computing power to generate the idea itself– a system that runs through an infinite number of possibilities to build the design. Autodesk has been working on a computational design, which is still in the experimental phase. For the last seven years, Autodesk has been crafting the PROJECT DREAMCATCHER, a system that analyses a list of the functional requirements of the required product and generates a CAD geometry.

This amazing process applies to buildings, bridges, automotive parts–everything we do where we have to draw things.

GRAB A CHAIR!

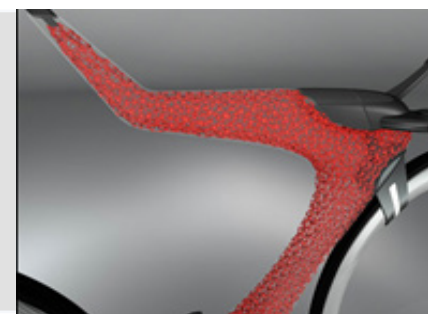
- Say, we want the chair to bear a load of half a kg and should be two feet off the ground.
- The program might come up with 1000 options for making the same chair.
- The program then combines the most efficient components of these 1000 chairs to generate 1000 new options.
- It can perform a million iterations, heading towards satisfying the designer, also suggesting the best material that can be used.
- These million iterations of the same chair are done in the time taken by the designer to describe just one

The Promise

This project does not aim at replacing the human acumen. The human kind is still better at making more instinctive selections over issues such as aesthetics. But the program certainly does serve up an array of options and can help sort through some of the more tedious aspects of the design process.

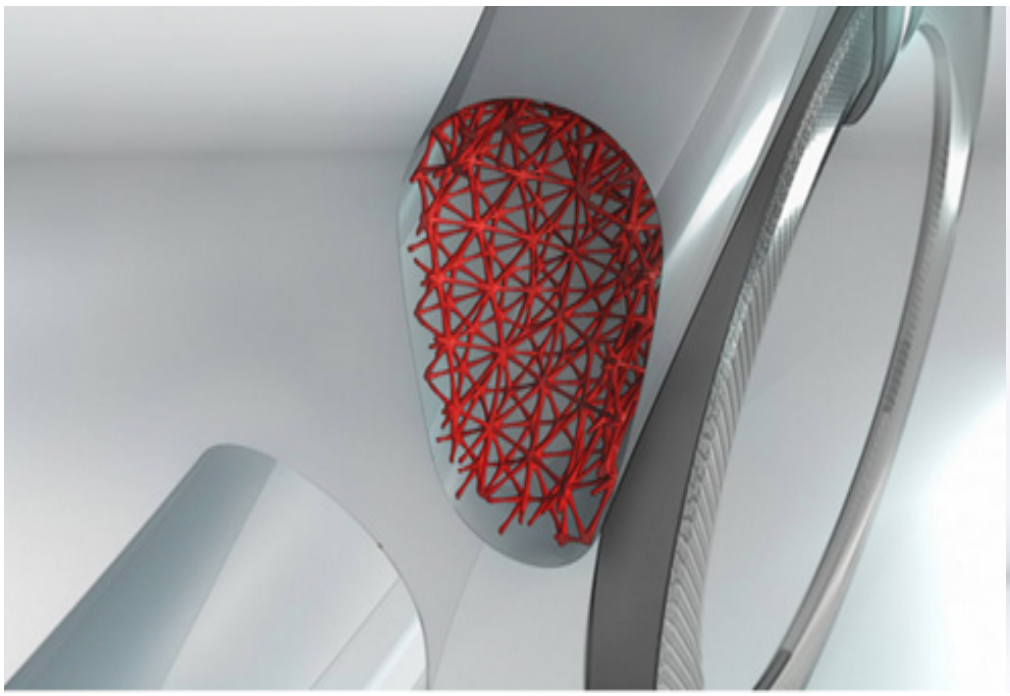
A BICYCLE RIDE

- Think of a design of a light weight bicycle.
- In order to reduce weight, the program uses the lattice aesthetics to build an efficient and suitable design for the same.
- The design could then be covered by a skin to give it a different look–so you're not limited to the lattice aesthetic, even if that's the most efficient material for that product.



The Predicament

What will be the role of human intelligence, creativity, insight, and foresight once we have artificial intelligence optimizing every aspect of human behaviour? The real question would be, what will be YOUR role in the future amongst the efficiency-oriented human race?



Digitalization and the Future of CNC

-By Vaibhav Gudi

FACULTY ARTICLES

Introduction:

The digitalization of CNC machines, mills, and other factory production equipment is the future that the Internet of Things has been promising us. Digitalization sounds like a word straight out of the new age machining, the representation of an object or process in the virtual world so that one can simulate movement, predict actions, and provide better insight. It is a growing trend in the industrial space, and the process finding its way into every corner of the factory floor.

What is Digitalization?

Digitalization is set to fundamentally transform and advance the machine tool industry. By linking the digital and real worlds, we will be able to open up new, significant possibilities for boosting productivity and developing totally new business models. It involves the massive collection of data with the help of sensor points attached to the ends of machine tools (such as CNC machines) on vibrations, forces, and temperatures.

The data collected is forwarded to the cloud for analysis with plans of transforming that data into a working virtual replica. More detailed the data is, more accurate the virtual twin will be. The latter then can provide accurate and practical simulation. Design engineers can rely on the results of the simulation to plan their machining processes effectively.

The conglomerate company - Siemens is a big player in digitalization. They have a line of tools and software products to aid in this process, including the NX Mechatronics Concept Designer for machine concepts and the CNC Shopfloor Management software for predictive maintenance.
Thus they have set forward a five-step plan on how to approach digitalization:

1. **Product Design/Machine Concept**

The product is digitally executed using computer-aided design and computer aided manufacturing methods (CAD/CAM). The machine concepts for the build are also computer modelled.

2. Production Planning/Machine Engineering

Manufacturers and builders plan and validate the procedures for production once the design concept is finished. This step is where the machine builders can customize the drives and programmable logic controllers used.

3. Production Engineering/Machine Commissioning

Here product manufacturers generate the code and validate the programming. Virtual commissioning for machine builders is completed to validate the machine processes. This step also includes user training either via - online learning or in-person instruction.

4. Production Execution/Machine Operation

Running the machines based on digitalization involves constant monitoring of the process and ensuring that the real world results match the digital results.

5. Services/Machine Services

In conjunction with sensors, predictive maintenance via the digitalization twin helps manufacturers avoid downtime. This helps machinists avoid production problems.

Benefits Beyond Manufacturing

Digitalization brings with it benefits that reach beyond manufacturing. For one, it's helping young engineers ease into manufacturing—an industry contending with an ageing workforce. Now to promote the same, Siemens provides software grants to universities and other institutes of higher learning to teach students about digital systems, and how to use them in real-world applications.

Students' Articles

New Engine Technologies That Can Drastically Improve Cars

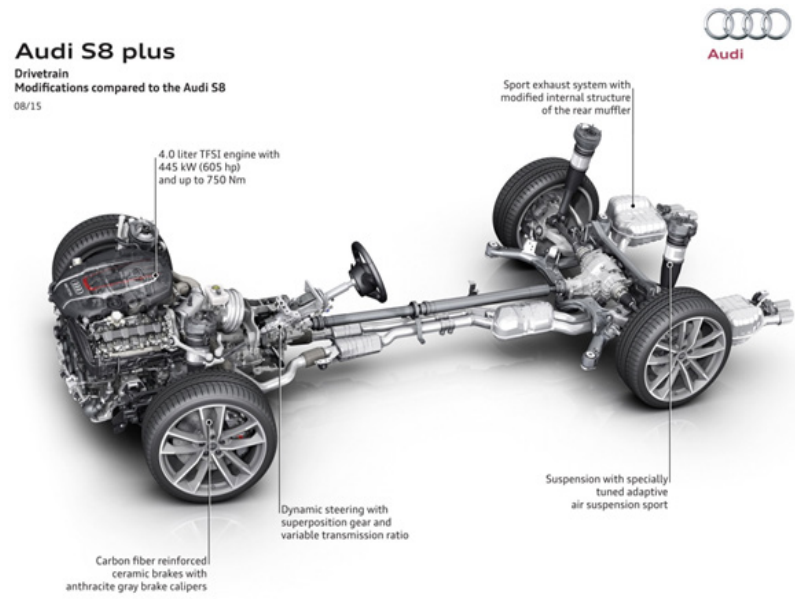
-By Mir Shabahat Aftab (TE Mech B)

The word engine derives from Old French ‘engin’, from the Latin ingenium–the root of the word ingenious and truly it has been the embodiment of that word .It has been the cornerstone of the industrial revolution and has aided us in everything from traveling short distance to landing on the moon.

The world of automobiles was dominated by internal combustion engines for the better part of the 19th and the 20th century but for the past few decades the development in the field of IC engines had somewhat dwindled and with the advent of electric and newer types of engines people had started to speculate that this, once indispensable piece of technology might languish into obscurity, but this testament to human ingenuity wasn’t going down without a fight and with some new developments the trusted IC engine seems to be back in the game. Some of those developments and innovation have been mentioned below.

1. Cylinders on demand

This type of engine only uses the cylinders it needs, when it needs them. For instance, when the Audi S8 is accelerating from 0 100 kilometers per hour in 4.2 seconds, it requires each of its 8 cylinders to be firing but when it reaches cruising speed after sometime, The workload on it Isn't that high, so four of those eight cylinders stop completely and the engine acts like a four-cylinder the cylinders start again if the need arises. Audi also uses an active noise control system to keep the sound of the engine and exhaust steady and active engine mounts so passengers don’t notice the change in cylinders. Thus the new v8 achieves more efficiency than the old V10 and is more powerful.



2) Flexible Dual Fuel Technology

This technology, to choose between regular petrol and an ethanol blend, has been around for a while. Ethanol blends are denoted with E followed by a number; E85 means the fuel is 85 percent ethanol and 15 percent petrol.

The Flex Fuel badge usually means the vehicle can use up to E85, as well as lower-percentage mixtures like E10.
We often see that big trucks and SUVs consume very high amount of fuel. Ethanol has a higer octane rating, but you get fewer miles per liter when using it luckily ethanol can be made from biological sources.

This mix is perfect for expensive performance cars,. Bentley Motors is trying to make all of its cars Flex Fuel-capable, beginning with the Bentley Continental SuperSports, the fastest Bentley ever built. The engineers at Swedish supercar company Koenigsegg followed suit and used ethanol to boost both power and green credentials. The limited edition CCXR model had an 806 horsepower engine which can utilize this technology to crank out about 1,018 horsepower.

3) Direct Injection

Most of the engines today mix fuel and air before introducing them to the combustion chamber. In a direct-injection engine, fuel is injected into the combustion chamber at the top of the piston's stroke, close to the spark plug. As a result a lot of pressure is generated in the combustion chamber, which can cause knocking just like higher compression ratios.

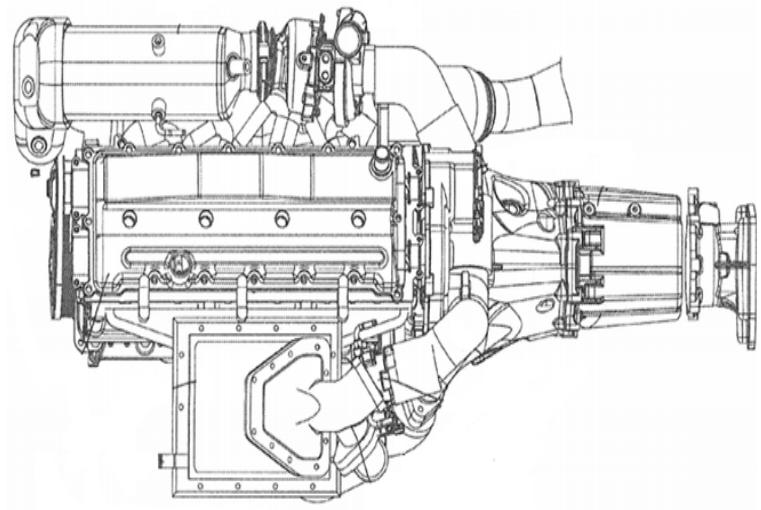
Direct injection with turbo charging has been incorporated by Ford Motor Company, which uses exhaust gases to boost performance and solve the problem of knocking.

4) Higher Compression Ratios

Increasing compression ratios can increase performance and fuel economy. Compression ratio is defined as the amount of fuel and air compressed into the combustion chamber. Higher ratio equals higher efficiency but the problem with higher compression ratios is usually a knocking sound in the engine, which occurs when temperature and pressure are too high in the chamber and the air and fuel mixture ignites too early. This issue can be somewhat addressed by high octane fuel but a longer exhaust manifold can reduce the temperature and the chance of engine knock. Also faster combustion time means the air-fuel mixture ignites properly before the temperature can build up and knocking begins. Weight reducing materials combined with this engine technology as well as new transmission means 15 % lower fuel consumption and emissions and 15% additional torque.

Mazda SKYACTIV-G system utilizes this technology.

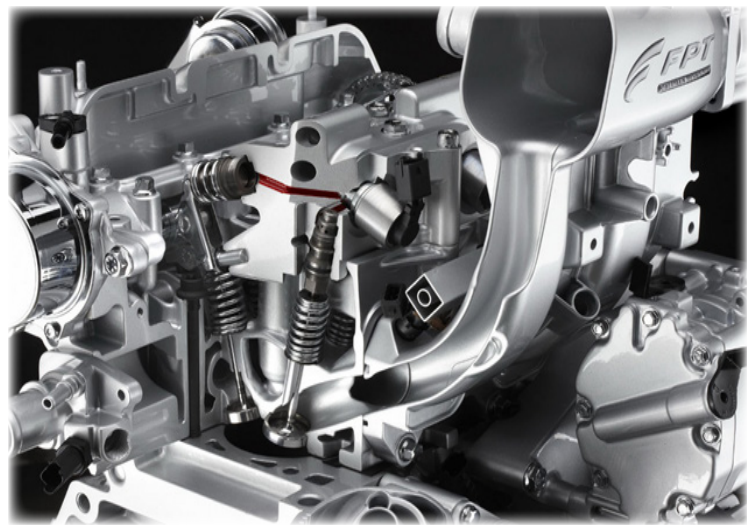
5) Twin Turbo and Electric Supercharger



This engine will not utilize its spark plugs at low loads; instead it will use compression for ignition akin to a diesel engine. That's not all though, a new patent application shows an engine that uses two turbochargers and an electric supercharger. The electric supercharger would be used to provide low-end power while the two exhaust-driven turbos coil up. It recovers energy from braking and turns it into electricity stored in a super-capacitor that sends power to the car's different accessories .

It's possible for this super-capacitor to power a supercharger rather than the air/conditioning

6)Variable Valve Timing and Lift



Valves open and close to allow air and fuel to enter cylinders and for the products of combustion to leave. Different valve timings produce different results (more power, better fuel economy). Conventionally, you couldn't alter that timing; it was set when the engine was designed.

But many modern engines can vary valve timing, allowing for default low RPM range of the engine to have more economical timing, and the higher RPM range to go for max power. This allows a smaller displacement engine to produce more peak power, so it allows for trimming and increased fuel economy

7)Exhaust after-treatments

Depending on the engine and vehicle size, different exhaust gas treatment (EGT) systems will be utilized. A new modular system has been developed by Bosch that comprises of a NOx Storage Converter before a double selective catalytic reduction (SCR).The NOx trap is custom-built for many city traffic situations due to the lower temperature limit of its working range.

Urea injection with the first SCR pooled with a diesel particulate filter reduces low temperature urban exhaust emissions. SCR further cleans the high temperature exhaust gases.

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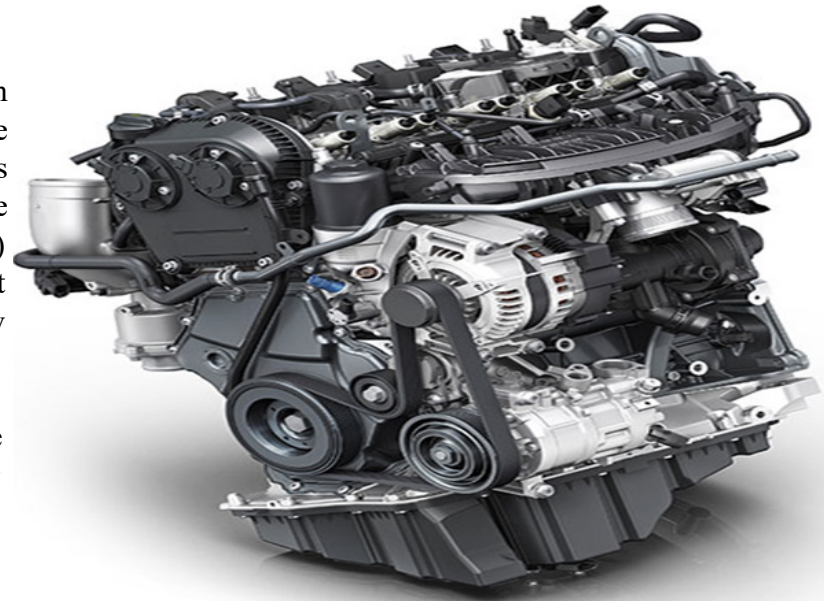
8) Shortened intake time



A four-cylinder engine that works on a new combustion method has been developed by Audi which it claims to be the most efficient two-liter gasoline engine in its category. The combustion method uses Miller cycle, and allows the 2.0-liter turbo unit to produce 140 kW, all the while giving an impressive 5.0 L/100km on the New European Drive Cycle (NEDC). 320 Nm (236 lb-ft) of torque is produced by this engine, all of which will be accessible from just 1,450 rpm, making it just the thing for surging into gaps in the traffic from low speeds.

To achieve this, Audi has shortened the engine's intake time by taking the crank angle and reducing it from 200 to 140 degrees. In spite of the shorter intake time, the engine can still achieve best possible cylinder charges thanks to higher boost pressure on its inlet side. Under the engine's new combustion cycle, the intake valve also closes in advance than it usually would, which allows Audi to run an efficiency-boosting high compression ratio. Thanks to this rightsizing approach, the new engine enjoys the consumption benefits of a downsizing engine in partial load operation, while at higher loads it has the advantages of a large-displacement engine.

This is just a glance into the plethora of innovations and developments happening in the world of IC engines and it is fascinating to see how far they have come since the Dutch physicist Christian Huygens first experimented with the IC engine in 1680. Looking at the how long this bit of technology has been with us , may be it will surprise us again.

Miniaturized steam turbine for freeze desalination

-By Ruchi Pourana (SE Mech B)

The Earth's surface is made up of 70 percent of ocean and accounts for 96 percent of the water on the planet. The problem is, this water can't be consumed. It's oversaturated with salt.

Desalination is the process by which saline sea water is converted into pure drinking water. So, with areas facing severe droughts and millions of people lacking access to clean water, could desalination be the answer to our impending melancholic future?

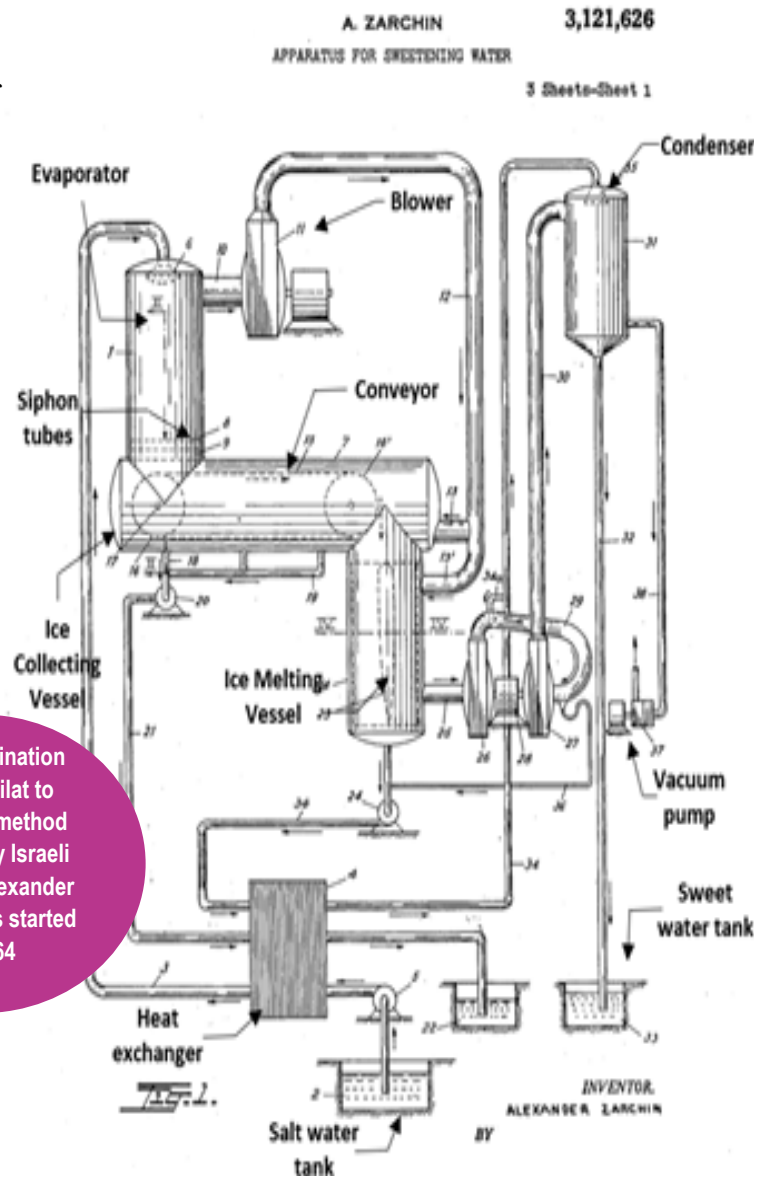
About Freezing Desalination

Among various technologies proposed for water desalination, freezing desalination technology has received the least attention. From a purely chemical point of view, impurities are naturally excluded from the ice crystal structures as they grow, since ice crystals will ideally be composed of pure water. Compared to other technologies, ice offers a number of advantages. For example, ice formation does not require sensitive components, such as membranes and high-pressure pumps usually employed in various membrane-based water separation technologies. Moreover, it does not operate at high temperatures usually encountered in distillation-based water separation processes. As a thermal process, the specific energy requirement for freezing desalination is about one seventh of that required for the distillation processes.

The Zarchin apparatus of desalination

The apparatus works as follows:

- While a vacuum pump runs and maintains in the whole apparatus a vacuum which amounts to about 3-4 mm of Hg in the evaporator, the crude water, e.g. sea water containing 3.4 percent salt by weight, is pumped from the tank into the evaporator and is cooled on its way to about -1o C. by the heat exchanger.
- As the water is sprayed out by the spray head into the evaporator, 7 percent of the water evaporates under substantially adiabatic conditions whereby 43 percent of the water is frozen, while the entire salt concentrates in the remaining about 50 percent.
- This brine or mother liquor, whose salt contents have risen to about 7% by Weight, does not freeze. With the salt concentration indicated above the freezing temperature of the incoming water is about - 4 to -5°C.
- The frozen portion should theoretically be pure water ice. In practice, some salt is mechanically retained therein but the proportion thereof stays well within the limits admissible for water destined for drinking, domestic or agricultural purposes.
- The water vapours formed in the evaporator are drawn off by the blower and discharged into a pipe.
- The slushy mixture of ice and brine drops into the ice collecting vessel through the overflow siphon tubes in which it forms a liquid seal, preventing vapours to pass into the ice collector.
- In the ice collecting vessel the mixture is taken up by the conveyor which carries the ice towards the melting vessel and at the same time filters it.
- In the left-hand part of vessel, the filtrate is formed by the brine. As the ice proceeds on the conveyor to the right, some vapour, entering through the branch, condenses in contact with the ice and the water thereby formed from the vapour and some melted ice washes the remaining ice substantially free from adhering brine.
- The aggregate filtrate of brine and washings runs off through the drains and is pumped by the pump through the heat exchanger into the waste-liquor tank, or simply into a drain.
- As the ice drops from the conveyor into the melting vessel it is contacted with the vapour delivered by the blower through the pipe and the branches.



First desalination plant in Eilat to utilize the method invented by Israeli scientist Alexander Zarchin was started in 1964

- The vapour has been slightly warmed, say to about 0 to 1^0 C, by the action of the blower, while the temperature of the ice has also somewhat risen during the transport from the evaporator to the melting vessel and is now about 0° or very little below 0° C. Therefore, the large amount of heat liberated by the condensation of the small proportion of vapour is sufficient to bring about the melting of the entire, much larger proportion of ice.
- The sweet-water thus produced from the aggregate amounts of vapour and ice is pumped through the pipe into the condenser, passing on its way through the heat exchanger. In the condenser it is atomized by the spray head.
- Finally, it collects on the bottom of the condenser and descends through the tail pipe to the sweet-water tank.

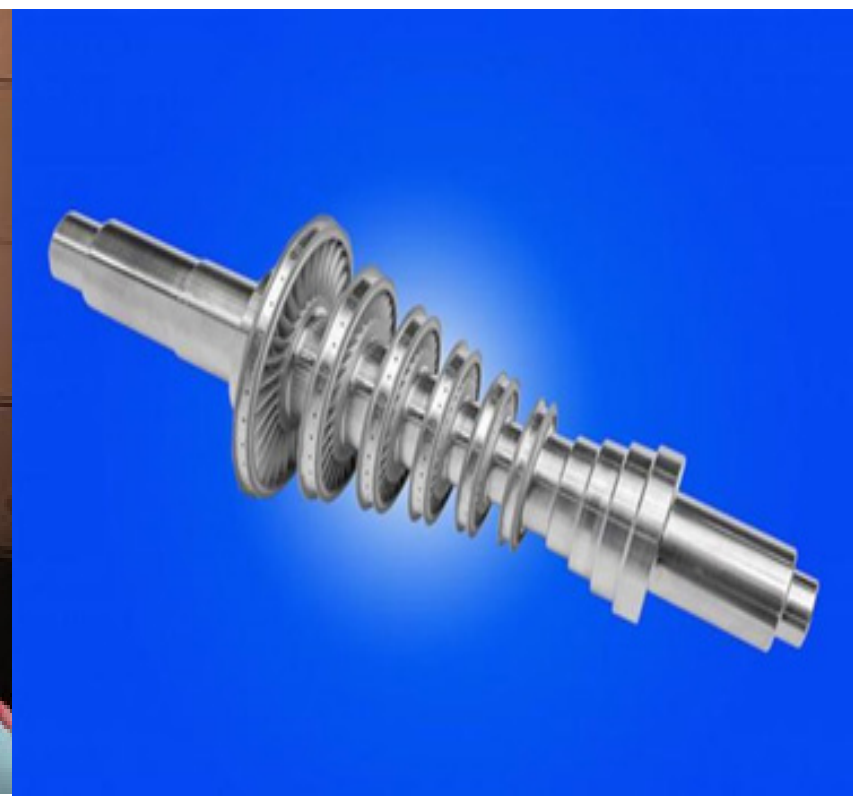
After the trip to the history, let's see what the future holds.

Miniaturized 3D printed steam turbine

No, we are not deviating from the topic of desalination. A stream turbine can possibly be used to freeze the brine and desalinate sea water. Scientists at General-Electrics Global Research (GRC) are working with the U.S. Department of Energy to develop a super-efficient desalination machine that fits in the palm of the hand. Originally designed to generate electricity, the steam turbine is shrunk to fulfil the needs of this innovation. The steam turbine turbomachinery 3D printed in a miniaturized form to compress and stream a mixture of air, salt and water through a hyper-cooling loop that freezes seawater. By freezing the mixture, the salt naturally separates in solid form, as we learnt above, leaving just the ice. The ice is then melted, leaving clean water.

If successful, the system could reduce the cost of water desalination by as much as 20 percent.

The mini desalination system combines 3D printing with the knowledge of turbo-machinery and fluid dynamics. But, this allowance from condensing liquids to freezing solids requires new and innovative solutions to address several challenges of this new turbine application.
Steam turbines already have proven to be one of the crucial innovations that generate and spread electricity to nearly every home and business. Miniaturized, they just might hold the key to spreading water desalination around the world



VORTEX BLADELESS WIND TURBINES

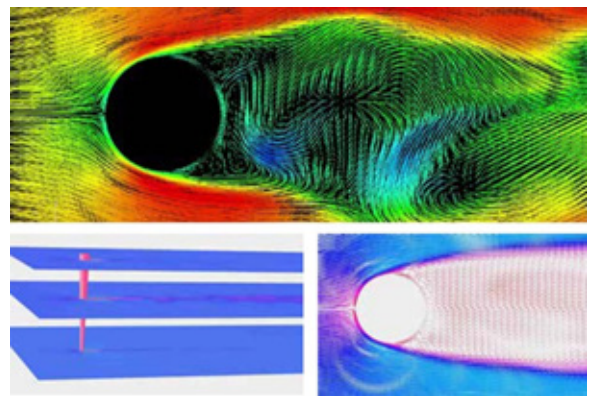
-By Shivani Velapure (SE Mech B)

Introduction

Conventional wind turbines have three blades and are either Horizontal Axis Wind Turbines (HAWT) or Vertical Axis Wind Turbines (VAWT). Vortex-Bladeless is a Spanish startup whose objective is to develop a new concept of a wind turbine without blades called Vortex Bladeless Wind Turbine.

David Yáñez, one of the company's co-founders, first came across the concept as a student studying the collapse of the Tacoma Narrows Bridge in Washington. The bridge collapsed in 1940 due to excessive vibrations formed by the spinning motion of wind as it blew past the bridge and is a textbook engineering failure. Yáñez, however, learnt a different lesson. "This is a very good way to transmit energy from a fluid to a structure," he says. Vortex Bladeless Wind Turbine works on the principle of Vortex Shedding.

Principle



Vortex shedding is an oscillating flow that takes place when a fluid flows past a bluff body at certain velocities, depending on the size and shape of the body. A bluff body is a body that by virtue of its shape, separates flow over a substantial part of its surface. When a body is kept in a fluid flow, the fluid does not touch the whole boundary of the object. When a cylinder is placed in a flowing fluid, a vortex is in the process of formation near the top of the cylinder surface. Another vortex gets formed below and to the right of the first vortex after the first vortex is shed. Thus, alternate formation and shedding of vortices takes place from one side to the other, in the direction of flow. The vortices formed are low pressure zones. The object has a tendency to move towards the low-pressure zone.

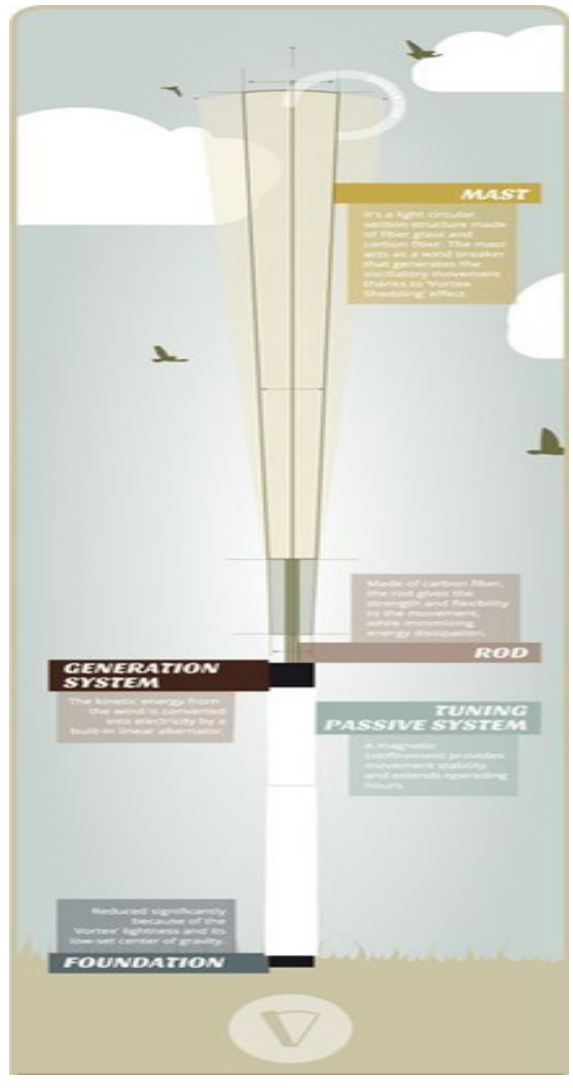
Vortex Shedding is of major importance in engineering design because the alternate formation and shedding of vortices also creates alternating forces, the frequency of which increases as the velocity of fluid flow increases. A sound is heard when the frequency is in the audible range and the body appears to sing. Resonance occurs when the vortex shedding frequency is near the structural-vibrational frequency of the body. Strouhal number, 'Sr' is a dimensionless number commonly used to measure the predominant shedding frequency 'fs'. It is given by the formula:-

$$Sr = \frac{f_s L}{U_\infty}$$

Where L is the characteristic length, equal to the diameter in case of a circular cylinder or tube in cross flow and U∞ is the freestream velocity.

Design

The outer conical cylinder, also known as the mast is designed to be substantially rigid and has the ability to vibrate, remaining anchored to the bottom rod. The top of the cylinder is unconstrained and has the maximum amplitude of the oscillation. The mast is built using the same materials used in conventional wind turbine blades, namely resins reinforced with carbon and/or glass fiber whereas the inner rod is made of carbon fibre, which gives it strength and flexibility, and minimizes energy dissipation. The inner cylindrical rod penetrates the mast for 10% to 20% of its length (depending on the size of the mast) and is anchored to it at its top and secured to the ground at its bottom part. It is built to provide highest resistance to the fatigue and allow its elasticity to absorb the vibrations generated by the cylinder.A semi-rigid coupling allows the upper section of the turbine to undergo reciprocating motion, while a linear alternator housed in the lower section converts the mechanical energy produced by this back and forth motion into electricity. The linear alternator works on the principle of electromagnetic induction. The foundation of the turbine is reduced drastically because of the light weight structure.



Typically, a structure can only be optimized to oscillate at the specific frequencies caused by a certain wind speed. A ring of magnets has been mounted at the base to get the most out of the movement of the mast, for all wind speeds. The Vortex wind generator successfully adapts its natural frequency to resonate with the frequencies of wind vortex generation within a varying speed range.The natural frequency of vibration depends on the mass and rigidity of the body. As the mass increases the frequency decreases and as the rigidity is increased we obtain a higher frequency.

The Vortex generator- including the diameter of the structure, height and total mass- is designed to achieve maximum performance from the average observed wind speeds.

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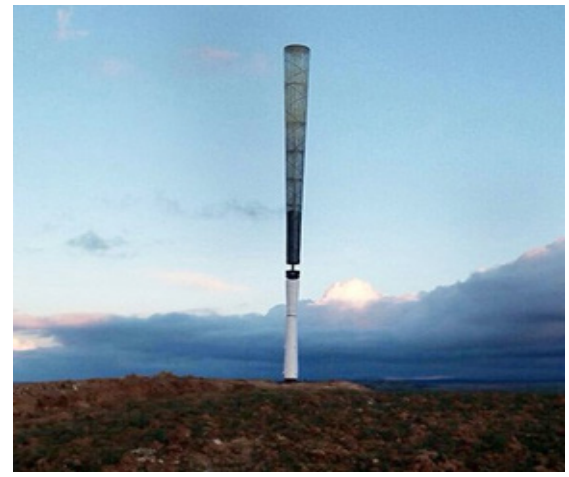
The company further maximizes the output from a given wind speed by modifying the rigidity of its structure. The top of the rod has a magnetic confinement system with permanent magnets that increase the apparent stiffness of the system according to the degree of flexion.When the wind intensifies, the distance between the rod and the magnets reduces, by virtue of which the magnetic force of repulsion increases. Thereby increasing the oscillation and the potential of generated energy to the maximum values. Therefore, the Vortex can automatically vary rigidity and "synchronize" with the incoming wind speed in order to stay in resonance without any mechanical or manual interference.



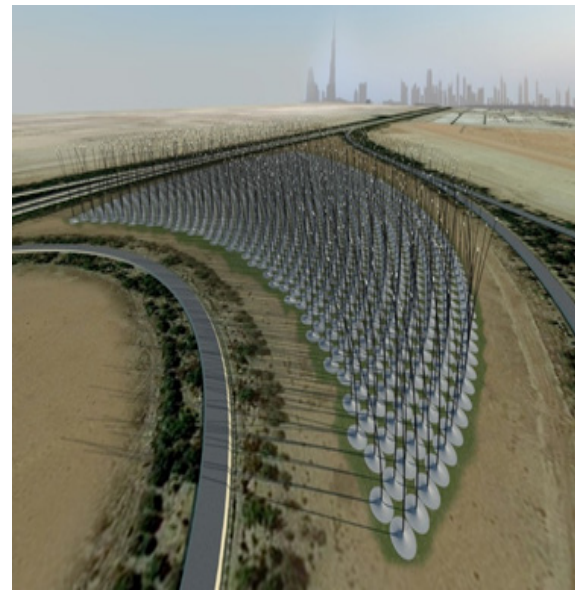
Advantages

1)Significant cost reduction:
The cost of producing energy, inclusive of the total manufacturing, transportation, maintenance and operational cost; by using Vortex Bladeless Wind Turbine is less than 40 percent than that of conventional wind turbines. Conventional wind turbines have a very heavy top portion because of massive turbine blades, generators and gearboxes which are present on support towers 100 meters off the ground. The assembly can weigh more than 100 ton. As the weight and height of the turbines increases, the material costs of wider, stronger support towers, as well as the cost of maintaining components housed so far from the ground, are cutting into the efficiency benefits of larger turbines. The simple design of the Vortex Bladeless Wind Turbines reduces the manufacturing cost to approximately half of that of a traditional wind turbine. The cost is greatly reduced due to the maintenance, as the Vortex doesn't have moving parts or gears, it will last longer and won't require periodic lubrication.

2)No gears or moving parts are in contact, so there is no friction. This increases the lifetime of the turbine because there will be negligible wear and tear.

3)There is no need to adjust the installation for the best angle of the wind.

4)Improves on limitations associated with the 'shadow effect', the disturbance of the downstream wind current, which is why traditional wind turbines need to be installed at a certain distance from each other.



5)It minimizes the threat to birds and bats.

6) Operates silently as the oscillation frequency of the equipment is below 20 Hz, the sound level impact is nonexistent.

Limitations

The Vortex Turbine is 30% less efficient in energy conversion as compared to conventional turbines. This shortcoming can be compensated by placing twice the number of Vortex turbines in the same space as a propeller turbine. A conventional wind turbine generally converts 80 to 90 percent of the kinetic energy of its spinning rotor into electricity. Yáñez claims that his company's custom-built linear generator will have a conversion efficiency of 70 percent. The Vortex turbine will cover a smaller area and have a lower conversion efficiency but significant reductions in manufacturing and maintenance costs will outweigh the losses.

Future Scope

Due to the significant difference in the project concept, its scope is different from conventional wind turbines. It is particularly suitable for offshore configuration and it could be employed in wind farms and in environments usually closed to existing ones due to the presence of high intensity winds. The initial Vortex Bladeless products are being designed to produce 100 watts of power for use in Africa and India. The company also plans versions that will deliver 4 kW for use in conjunction with solar panels and 1 MW for larger applications.

Design of Zip Chain Lifters

-By Pradeep Kapri, Paresh Chaudhary, Prabhakar Nikam(SE Mech A), Vikas Tiwari(SE Mech B)

Abstract:

Conventional methods of lifting include lifting the weight with the help of cranes, forklift or by any type of lifting mechanism. A major problem in lifting and lowering applications is moving loads at a linear rate while maintaining steady and level positioning on vertical and horizontal plane. The factors considered while lifting any object is the durability of the lifter as well as the time and speed required to lift the object. Zip chain lifter employs a lifting mechanism that uses zip chain to directly transmit upward and downward thrust, thus lifting the object. The zip chain lifter consists of chain and sprockets mechanism for transmission of motion and force from one part to another. When lifting, the Zip Chain Lifter engages two zip chains to form a strong, rigid, column-shaped body that pushes up the platform, while when descending, the chains are unlinked and moved in a compact housing. Power is transmitted through a single strand chain when the driver sprocket rotates and the teeth interlock the chain, pulling the chain around it causes it to rotate.

Introduction

Lifting operations are intrinsic to many occupations in the construction industry. They can be performed manually or by using any type of lifting equipment. Both manual lifting and mechanical lifting operations can put construction workers at great risk of life causing absence due to injury or disability.

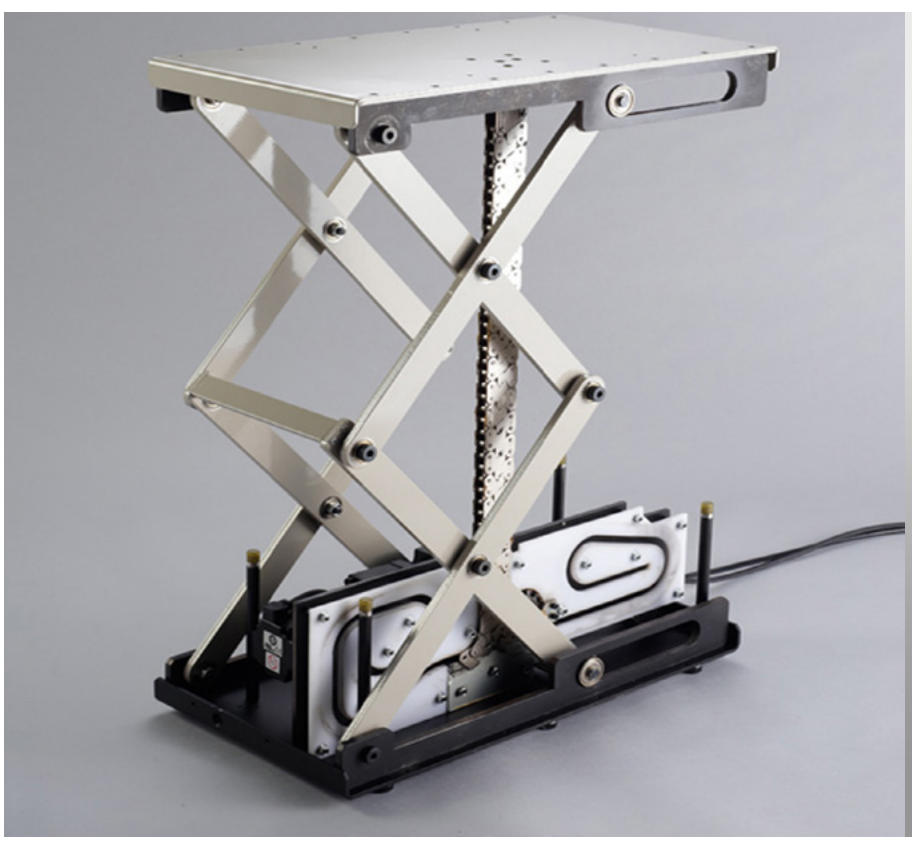
A lifting operation is concerned with the lifting and lowering of load. There are various types of lifting equipment such as cranes, forklift, hoist, hydraulic lifters etc.; which are used for lifting and lowering load however the equipment used depend on the type of the application. All the equipment must satisfy the factors which are essential for lifting the load such as it should have high speed, long life durability, ease of installation, greater thrust efficiency etc. Zip chain lifter use zip chain and sprocket mechanism to lift and lower the load accordingly. It is so named because it consists of two chains that interlock in zip-like fashion to form a single, strong column. Ordinary chain is used for pulling purpose and is not capable of transferring power when pushed, while zip chain can be used for both the pushing and pulling operation. The zip chain lifter has simple structure, better stability and reliability.

Chain and Sprocket Mechanism

The power sources such as wind generators, turbines or drive shaft of electric cars produce rotary movement as output.. The out-turn rotary movement and force must be transmitted from the power source to a machine with the help of mechanisms that will use the energy in some way. For this purpose different types of mechanism are used out of which one is the chain and sprocket type mechanism. A Sprocket has projected teeth that fit into recesses of chain and is used to pass the motion and torque from one shaft to another. A chain is made up of series of links with the links held together with a steel pin. Together chain and sprocket work as a mechanism for power transmission. The number of teeth between the driven and driver sprocket determine the speed and torque of the chain and sprocket mechanism. The contour action of the chain link causes some frictional losses between sprocket and chain; hence for this purpose lubricants are used. Power is transmitted through a single strand chain when the driver sprocket rotates and the teeth interlock the chain, pulling the chain around it causing it to rotate. The chain drive uses the engagement of sprocket teeth and chain to drive it.

2.Design of zip chain lifters

Zip chains are two strands of chains that interlocks in a zipper like fashion to form a single, strong column that enables push/pull operations over a long stroke. The unzipped chain can be more compactly housed than pneumatic and hydraulic cylinders. It has simple structure, better stability and higher reliability. The design of zip chain lifter consists of zip chain, sprockets and bearings and rollers. The materials used for the manufacturing of chain and sprocket depend upon the torque and power needed to be transmitted. Generally the metals used for manufacturing are alloy steel and cast iron with suitable alloy properties followed by the heat treatment for tempering and case hardening the equipment. Zip chain lifter is so named because it consist of two zip like chain that interlock between to form a single column like structure for support of scissors bearings and rollers. Zip chain follows mechanisms that transmit drive force more efficiently than electric/hydraulic lifters.



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Working of zip chain lifter

The zip chain lifter is a new lift table that maximizes the zip chain and sprocket mechanism to move it forward and backward. This groundbreaking, electrically driven lifting mechanism multiplies the energy efficiency as compared to conventional hydraulic lifter. The working of zip chain lifter is basically dependent on the chain and sprocket mechanism, the zip chain is mounted over the sprocket which rotates both anticlockwise and clockwise direction to provide forward and backward motion. The sprocket rotates and Zip chains interlock to form a strong column support which is used for upward motion or lifting of the object. This continuous rotating motion of sprocket moves the zip chain upward and downward. The zip chain has a scissor metal lifter and roller bearings to provide the required support for the lifting or lowering of load. Once the motor is supplied with power, it starts rotating the sprocket and the chain from the housing gets locked in the space of sprocket thus lifting up the slab along with the zip chain. The roller support at the end provides the required support for the base (on which load is kept) to lift or lower the load. Also it acts as a compact spacing and hence providing better stability and reliability.

Drive unit

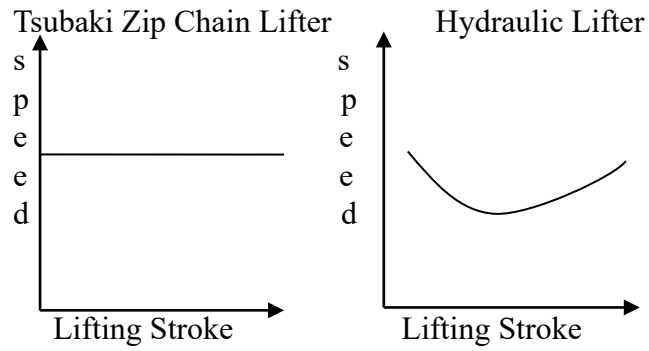
The drive unit consists of zip chain, sprockets and motors. The engagement of the zip chain and sprocket with projected teeth transmit power efficiently. The sprocket teeth get engaged in the spaces of zip chain for pushing and pulling operation powered by servo/induction motors for rotation of sprockets. Zip chain lifter uses the truss principle (i.e. cross sectional arrangement of metal strand) for the extra support required to lift or lower the load. The sprockets can be rotated in both the clockwise and anticlockwise direction with the help of D.P.D.T switches.

Lift speed is directly proportional to the motor rotation speed. The speed is constant throughout the stroke range. High speed vertical conveyor with special zip chain provides and optimizes flow line in the work place.

Features

- **Excellent Speed and Position Control**

Zip chain uses the simple multi-stage control mechanism. In zip chain lifter the speed is same throughout the stroke range hence it follows a constant path of speed. The positional accuracy of zip chain lifter varies within +/- 1. Arranging multiple stops and multi-level positioning can be easily done with repeatable stopping accuracy at many points.

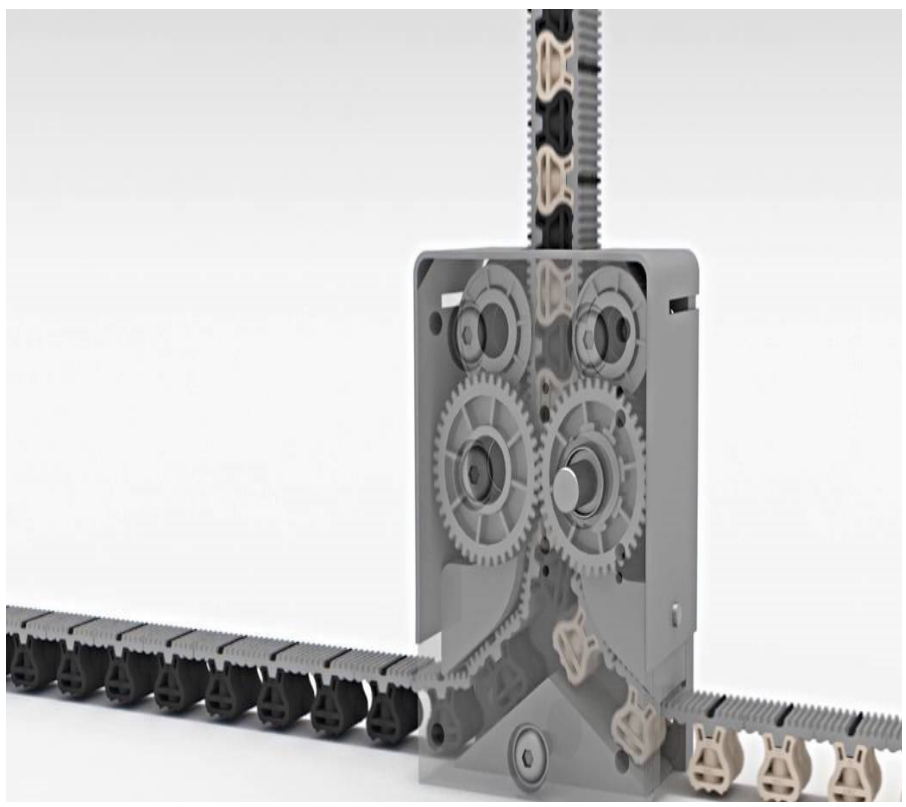


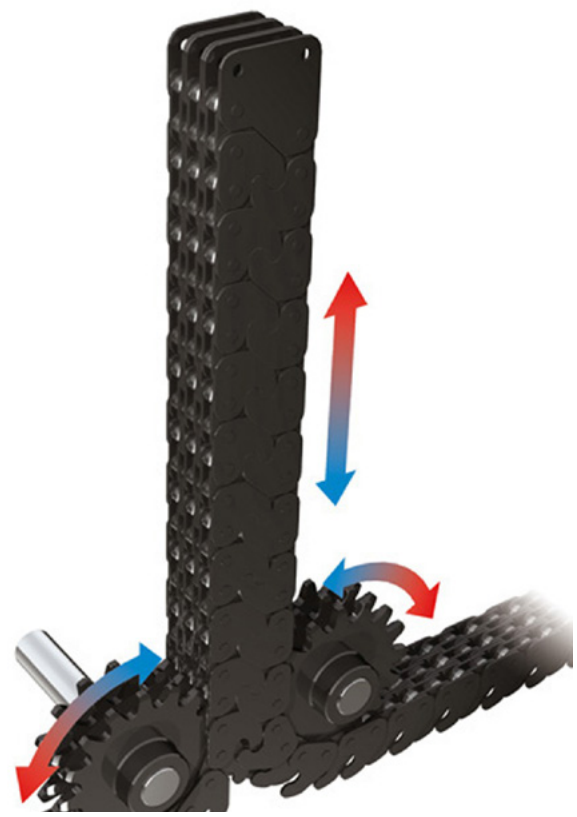
- **High speed and high frequency operation**

The zip chain lifter operates multiple times faster than hydraulic lifter. The mechanism provides greater stability thereby enhancing the rate of frequency of lifters. In hydraulic lifters due to increase in oil temperature it needs to be held down for few minutes or seconds to let the oil cool, thus limiting the frequency of operation. While in case of zip chain lifter no such obstructions are observed.

- **Greater thrust efficiency**

Driving force is transferred directly since the zip chain mechanism pushes up the platform instantly. A minimal load is placed on the roller bearing and hinges. While in case of hydraulic lifter a large amount of thrust is needed at initially, as the cylinder pushes the bar in an oblique direction. Zip chain instantly pushes the platform so that motor torque can be transmitted without any losses.





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- **Energy efficiency**

As compared to conventional lifting methods, zip chain lifter is more efficient. In a way it can provide much higher speed and greater operational frequency limiting the losses. It also features a regeneration unit that returns some amount of energy produced when the platform is lowered to the primary power system, allowing the lifter to recover 30 percent of electricity consumption. The Zip chain lifters are more energy efficient in terms of transmission efficiency as it uses the diagonal push of hinges to support the platform carrying load.

Limitation

The chain drives need accurate mounting and maintenance, particularly lubrication and slack adjustment.
In an extreme condition the chain might break due to certain expansion or contraction in the drive.
It cannot work without electricity supply, since the rotational movement to the sprocket is provided by motors.
The size of zip chain and sprocket limit the application as for varying loads, size of zip chain and sprocket varies accordingly.

Application

- Zip chain lifter can be installed on an automated guided vehicle with small footprints.
- Lateral pushing and lifting of components.
- Operator lifter.
- With the high durability and ease of application it can be used in any machinery for lifting or pushing the load.
- To lift or lower the loads.
- With increase in number of chains and sprocket extra support can be provided for lifting or lowering of loads.

Conclusion

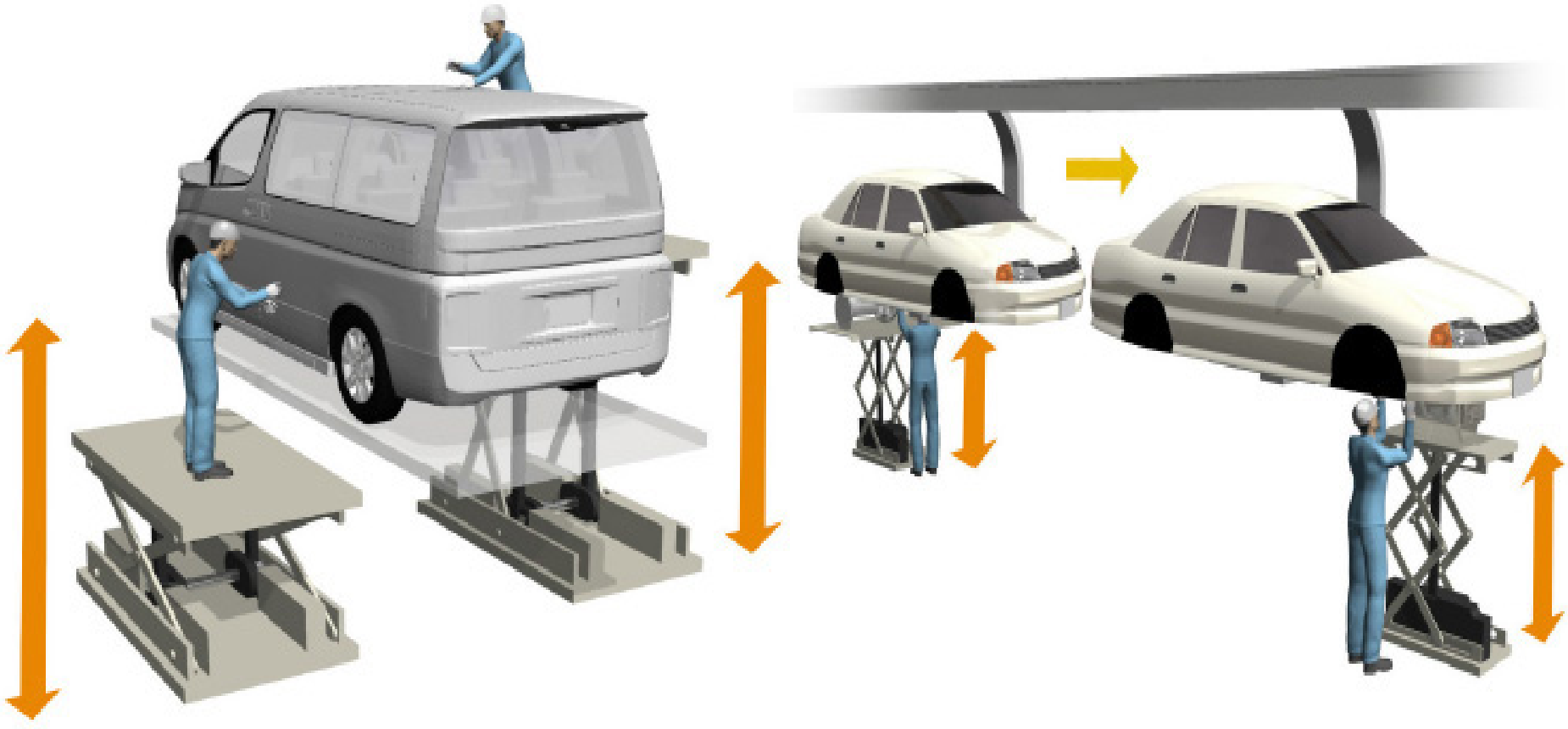
The zip chain lifter follows the most convenient and simplistic approach compared to other lifters used in industries. The compactness and high durability with ease of application maximize the application of zip chain lifters.
Although this technique is quite efficient and easy to operate it covers most of the drawbacks of the conventional system. It is clear that it can perform high speed and high frequency operations much better than manual lifting.

The article has demonstrated various merits and demerits of this system but these flaws can be avoided by timely precautions and handling.

The key emphasis is on great thrust efficiency from industrial application perspective.

In addition, high durability increases the life of the zip-lock and sprocket mechanism.

Since the industries already have a hydraulic process for lifting operation, it is possible that zip lock mechanism could monopolize the industrial environment and lifting operations.



Lasers In Defence

-By Aditya More(SE Mech A), Nitin Vishwakarma, Harshal Tanawade, Yash Shah(SE Mech B),Krishnakant Mishra(Faculty)

Abstract:

In today's world, there is rarely any scientific field which is not influenced by laser technology. In our paper, we will be particularly focusing on the applications of laser in defence and military. After 60 years of regressive research and experimentation on lasers, it has finally found its place in the field of defence and military. It is used in various defence applications like Mid-Infrared Advance Chemical laser (MIRACL), Air Borne Laser (ABL), Tactical High Energy Laser (THEL), Laser Guided Weapons, LiDAR, etc. It has been found to be very useful where safety and security are top priorities. Although there are many limitations for implementing Laser Technology in the area of Military and Defence, still there is a lot of scope for future development in this field. So, the scientists are developing new Defence Systems, which will increase the security of nations against foreign threats.

1. Introduction

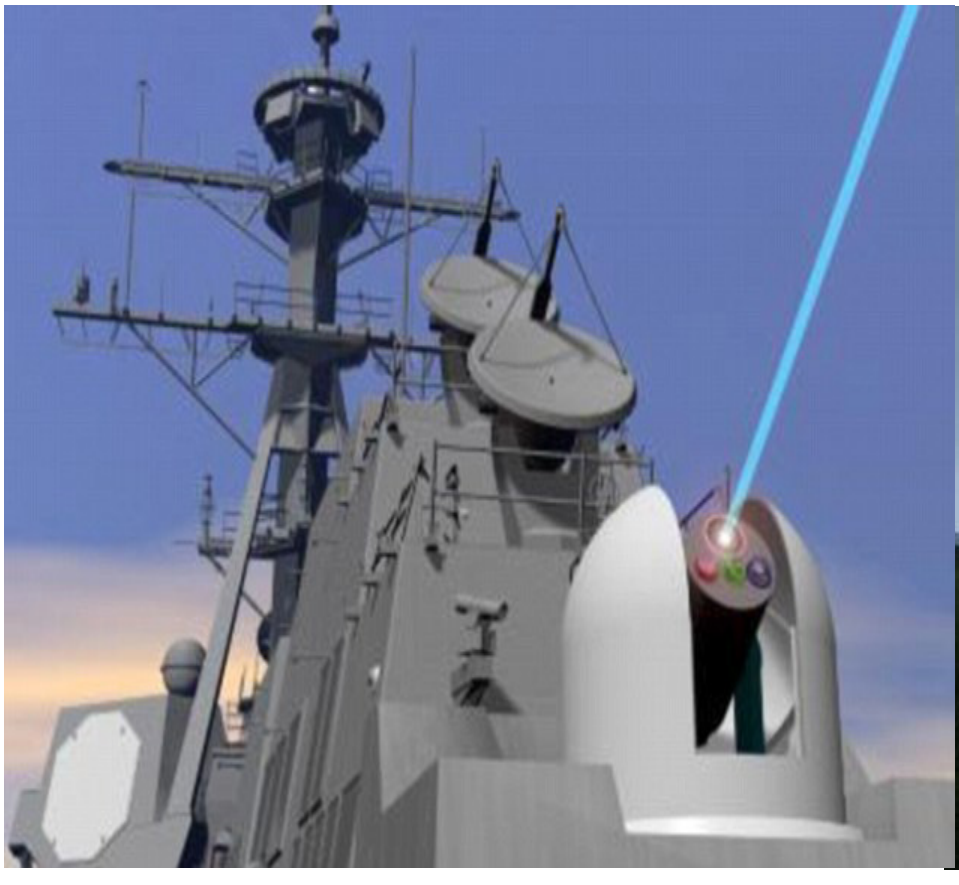
Light Amplification by Stimulated Emission of Radiations which is also written in short as "LASER", was theoretically discovered in 1957, but the first laser built in 1960 by Theodore H. Maiman at Hughes Laboratory, which was used the theoretical work of Charles Hard Townes and Arthur Leonard Schawlow. A Laser has properties like high coherency and high intensity which makes it different from other sources of light. The property of laser called spatial coherence allows laser to be focused onto a very tight spot, which is useful in laser cutting and lithography where accuracy is a top priority. While it also allows collimation of a laser beam due to which it follows a rectilinear path. This can be useful in laser pointers. As they emit light of single wavelength i.e. single color, they also have temporal coherence, which can be used to produce pulses of light of the order of femtoseconds. Due to these properties of laser, they are widely used in today's industry, with variety of applications like Barcode Scanner, Laser Printers, Fiber Optics and Free Space Optical Communications, Laser Surgery and Cutting and Welding of Metals, Laser Lighting Displays, which are used for entertainment purpose. But, in the past few decades, it has been emerging as a modern technology in Defence and Law Enforcement Devices used by Military for various purposes.

2. MIRACL

MIRACL which stands for Mid-Infrared Advanced Chemical Laser. MIRACL is a type of Directed Energy weapon, which is collaborated by the US Navy. The MIRACL is a type of Chemical Laser which uses Deuterium Fluoride as a chemical medium to produce high-intensity laser. The MIRACL Laser first commenced in 1980. It can generate over a megawatt of output for up to 70 seconds, which is the most powerful unceasing wave laser in US. The main mission of MIRACL was to be able to track and destroy anti-ship cruise missiles, but after some years it was first tested at a contractor facility in California. Later during 1990-2000, it was located at a facility in the white sands missile range in New Mexico.During the mid of October 1997, it was tested against MSIT-3, which is US Air -Force Satellite at the end of its original mission in orbit at a distance of 432km. But MIRACL underwent failure during the test and was damaged. The Pentagon claimed mixed results for other portions of the test. Whereas, a second laser, which was a low powered one was successful in temporarily blinding the MSIT-3 sensors during the test.

3. LOC

The border between India and Pakistan is about 3000 kilometers long out of which which 182 kilometers of border is unguarded due to hilly area, Marshy land, etc. So, The infiltration from Pakistan is more in these sites. So, BSF took the decision of installing laser walls across this area of the border. KVI-101s system is used for these laser walls. The system KVI-101S requires very little human intervention, has advanced detection capabilities and the encryptions are hack proof. The new technology uses next generation IR optics to provide all-weather and harsh terrain early detection capabilities. With the help of infra-red rays and laser beam, the laser walls cannot just detect when there is a breach but can also differentiate between man and beast. Hence using this virtual border India will able to solve the issues of terrorism in those areas and also will able to stop infiltration of Pakistan.



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A further integration of laser wall with a system called miCRON has enabled encrypted communication for five layer fencing and complete automation of border holding is being designed and manufactured in India. The walls will be fully upgraded in western (Indo-Pak) border in near future. Furthermore, India is also planning to install these laser walls in eastern border as well.

4. Laser-Guided Bomb

A Laser Guided Bomb was first developed by United States during Vietnam War. This LGB is a guided bomb that uses semi-active laser path to strike a target with a higher accuracy than any other unguided bomb. They have quickly shown their potency in precision strikes of difficult point targets. These weapons use an electronic board to track the targets by designated laser. Nowadays, these bombs are one of the most common and widespread guide bombs. These are used by large number of World's Air Forces. These weapons, first developed in United States and United Kingdom in early 1960s, where United States Air Force issued the first development contract in 1964. With the support of IRDE, a lab of DRDO India built its first Sudarshan laser-guided bomb in October 2010. This is the part of ongoing research to achieve self-dependency in defence area.

5. Anti-Ballistic Missile

The thought of destroying rockets before they can hit their targets was first made by Germans in their V1 and V2 program of World War-2, which provoked the idea of Anti-Ballistic Missile. It is a surface to air Missile which is designated to destroy a Ballistic missile. A Ballistic missile is kind of a missile that follows ballistic trajectory. Basically, these missiles are used to deliver nuclear, chemical and biological or conventional warheads in a ballistic flight trajectory. The "Anti-Ballistic Missile" is a laymans term depicting a system devised to intercept and destroy any type of ballistic threat. The Indian Ballistic Missile Defence Program is an initiative to develop and deploy a multi-layered ballistic missile defence system to protect from ballistic missile attacks.

Prithvi Air Defence (PAD) belonging to the class of missile is a high altitude interceptor and The Advanced Air Defence (AAD) used for low altitude interceptor. The first test of PAD was carried out in November 2006, followed by AAD in 2007. The positive results of PAD made India the fourth country in making an anti-ballistic missile defence system after United States, Russia and Israel. It is yet to be officially commissioned although it has undergone several tests

6. LiDAR

LiDAR known as the light detection and ranging system which adopts remote sensing method, that transmit light energy in the form of a pulsed laser to measure the distance of the target or variable distances on the earth. It sends a beam of laser which illuminates the target and by measuring the time interval of the reflected laser the distance of the target is calculated. It can be also called laser scanning or 3 -D scanning. It has many uses in the field of Geology, Geodesy, Archaeology, Geometrics, Atmospheric physics, etc. It has a very interesting history. LiDAR came into applications in early 1960s just after laser was invented. It is a combination of laser and focused imaging with an ability to calculate the distances by measuring the time for a signal to return using appropriate sensors and data acquisition electronics. Most importantly it was used in Apollo -15 Mission when the astronauts used the laser altimeter to map the landscape of the moon. Examples of military application of LiDAR are Air Borne Laser Mine Detection System. Airborne multilaser LiDAR is used to map the territory of the enemy i.e. to locate their tanks and warheads.

7. Space Defence

Project De-Star, a project given by scientist to destroy asteroids which are aiming towards Earth. This project is important as asteroids/space debris especially rocks are a few kilometers big but the destruction caused by them on earth will be devastating. Examples of asteroid caused destruction are 1: destruction or end of whole dinosaur species and 2: The Vredefort Dome, the Vredefort crater has an estimated radius radius of 118 miles (190 kilometers), making it the world's largest known impact structure. One asteroid, even a few kilometer big will cause more destruction than Hiroshima Nagasaki attack or even more than.

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any energetic weapon on earth. DE-STAR stands for Directed Energy System for Targeting of asteroids and exploration system to deflect asteroids, comets, and other near-Earth objects that pose a credible risk of impact. As we've seen above the objects that cross the earth's orbits even tiny ones, have a devastating effect on Earth. So NASA has introduced orbital planetary defence system which is capable of melting or vaporizing the object by heat produced by laser. Laser will just vaporize or cut it down into fine pieces. DE-STAR is a modular phased array of kilowatt class lasers powered by photovoltaics. We consider two classes of systems, Large "stand-off" DE-STAR arrays, which remain in Earth orbit and deflects the target from afar. The modular design allows for incremental development and tests, lowering cost, minimizing risk, and allowing for technological co-development. DE-STAR is designed a stand-off that can accomplish task from a distance. While comparing DE-STAR and DE-STARLITE, DE-STARLITE is small and can be deployed on a single launcher but is still powerful i.e. capable of diverting large asteroids in given sufficient warning time.

In both the systems a highly focused laser light beam is targeted on an asteroid at a spot, the temperature at that spot rises up to ~3000K which will instantly vaporize the material in that spot and material gets ejected which alters the direction of asteroids or comet's orbit. Ideal DE-STAR systems can simultaneously engage multiple targets.

Project DEEP-IN:

As we know that we don't have such a technology that can go up to 2-3% the speed of light. But NASA has come up with an idea that can allow us to travel at approximately or greater than 25% speed of light and that project is named DEEP-IN. As we know, humans have sent a Voyager space satellite in 1977 and only now it has crossed our solar system.

DEEP-IN (Directed Energy Propulsion for Interstellar Exploration) is a NASA program to use massive directed energy to thrust small spacecraft to relativistic speeds to enable humanity's first interstellar missions. This program was started in 2009 with initial funding from UC Santa Barbara and the NASA Space Grant Consortium with funding from the NASA Innovative Advanced Concepts (NIAC) program from a 2014 proposal. NIAC Phase I funding began in April 2015 with Phase II funding started in May 2016.

9. Conclusion and Future Scope

The properties of laser like high-intensity high coherency make it a perfect choice for military and defence application. It has made huge impact on Law Enforcement sector due to its various ranging application of laser technology like LiDAR, ABL, THEL, etc. Scientists are still trying to improve the prototype designs of weapons and defence system which will reduce the cost and increase the efficiency. The Applications of laser technology are also being studied in India at various institutions and they are being researched for improvements.

Apache Helicopter

-By Abhishek Narayanan (TE Mech A)

Introduction:

History has seen a revolutionary development in war, the Apache Helicopter. The flying tank is precisely designed to survive heavy attack and impose massive damage. Ground forces are terrified of this lethal machine.

The Apache is the primary attack helicopter in the U.S. Arsenal. Other countries, including Israel, the United Kingdom, and Saudi Arabia, have also added Apaches to their task force.

The Apache has astonishing flight systems, weapon systems, engines, sensor systems and amour systems. Individually, these components are extraordinary fragments of technology. Combined together, they make up the fatal helicopter.

Aerodynamic Forces

The four basic aerodynamic forces are Drag, Thrust, Weight and Lift.

DRAG: Drag is an aerodynamic force that resists the motion of an object moving through a fluid. The amount of drag depends on a few factors, such as the size of the object, the speed of the car and the density of the air.

THRUST: Thrust is an aerodynamic force that must be created by an airplane in order to overcome the drag. Airplanes create thrust using propellers, jet engines or rockets.

WEIGHT: This is the force acting downwards or the gravitational force.

LIFT: Lift is the aerodynamic force that holds an airplane in the air and is probably the most important of the four aerodynamic forces. Lift is created by the wings of the airplane.

Working of a helicopter

A plane can move forward and turn left or right. It also adds the ability to go up and down. The helicopter can do three things that an airplane cannot:

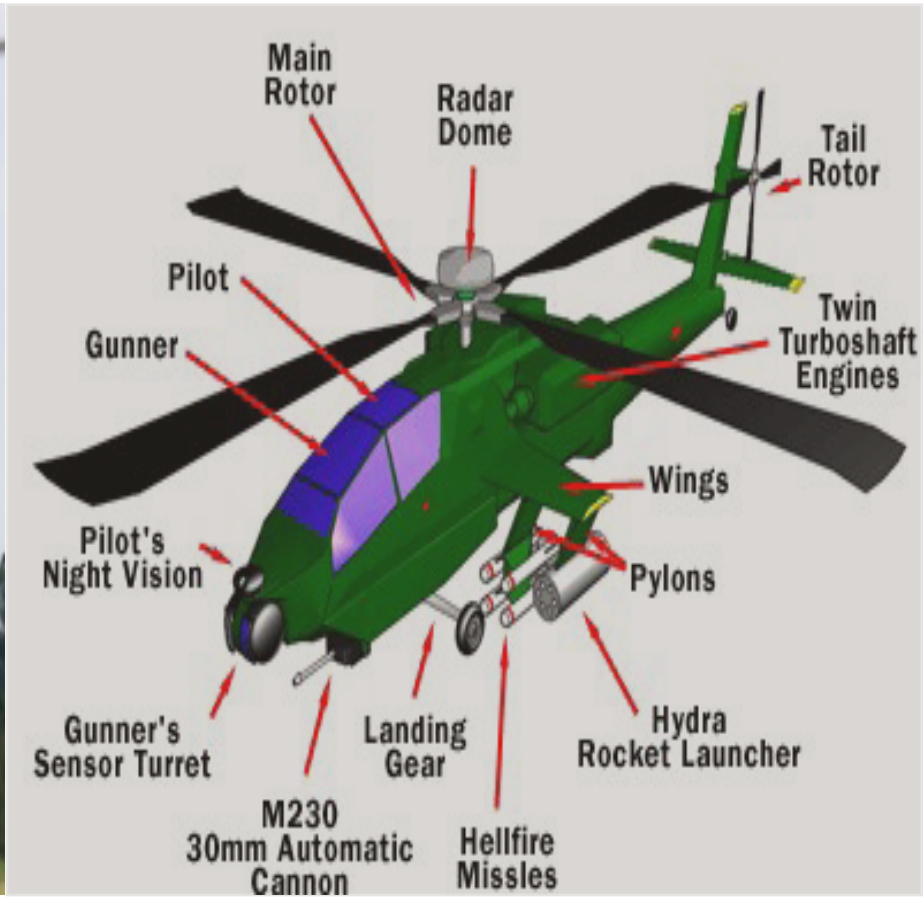
a. A helicopter can fly backward.
b. The entire aircraft can rotate in the air.
c. A helicopter can hover motionless in the air.

For continuous hovering, a rotary motion of the wing is the easiest way. The rotating wings of a helicopter are shaped just like the airfoils of an airplane wing, but generally, the wings on a helicopter's rotor are narrow and thin because they must spin very quickly. The rotating wing assembly of the helicopter is called the Main Rotor. If the main rotor wings are given a slight angle of attack on the shaft and shaft is spun, lift is developed by the wings.

In order to spin the shaft with enough force to lift the vehicle, an engine of great power is required. Reciprocating gasoline engines and gas turbine engines are the most common types. The engine's driveshaft can connect through a transmission to the main rotor shaft. The arrangement works really well until the moment the vehicle leaves the ground. At that moment, there is nothing to keep the engine from spinning just like the main rotor does. So, in the absence of anything to stop it, the body will spin in the direction opposite to the main rotor. To keep the body from spinning, a force is needs to act on it. Usually, force is provided to the body of the vehicle by attaching another set of rotating wings to a long boom. These wings are known as the Tail Rotor. The tail rotor produces thrust just like an airplane's propeller does. Now, the body of the helicopter is kept from spinning by the tail rotor, by producing thrust in the sideways direction. This counters the engine's tendency to spin the body. Normally, the tail rotor is driven by a long drive shaft that runs from the main rotor's transmission back through the tail boom to a small transmission at the tail rotor.

Apache Engine and its Working

The rotors of Apache Helicopters are powered by turboshaft jet engines. Some older or smaller helicopters use reciprocating piston engines for their power source while most of the helicopters today use gas-turbine engines. They are light, very powerful and economical. The best part is that they are very reliable as well.



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Failure rates for gas-turbine engines are very low because there are not as many internal moving parts as there are in a reciprocating engine.

"Suck, Squeeze, Burn and Blow"-These are the basic principles on which the engine works. The air is first “Sucked” by the compressor section positioned at the front of the engine, which is then “Squeezed” and made denser and feasible for combustion. This air is brought into the compressor by the turning compressor blades that are shaped like little airfoils. It is like a big fan that sucks air into the compressor. Stationary blade sets called "stators" are placed in between the moving rows of compressor blades. The stators change the course of the airflow and assist in the compression process. Due to compression, the volume occupied by the air is reduced. The air then passes through the diffuser segment which carries the air into the combustion chambers, which are in the combustion section. There, the “Burn” part occurs when the air is mixed with fuel and is ignited. Due to this an explosion occurs. This explosive burned fuel and air mixture then travels into the turbine section where the force is turned into a combination of drive power and thrust (or exhaust), which is the “Blow”. Depending on the conversion of force, two types of engines:

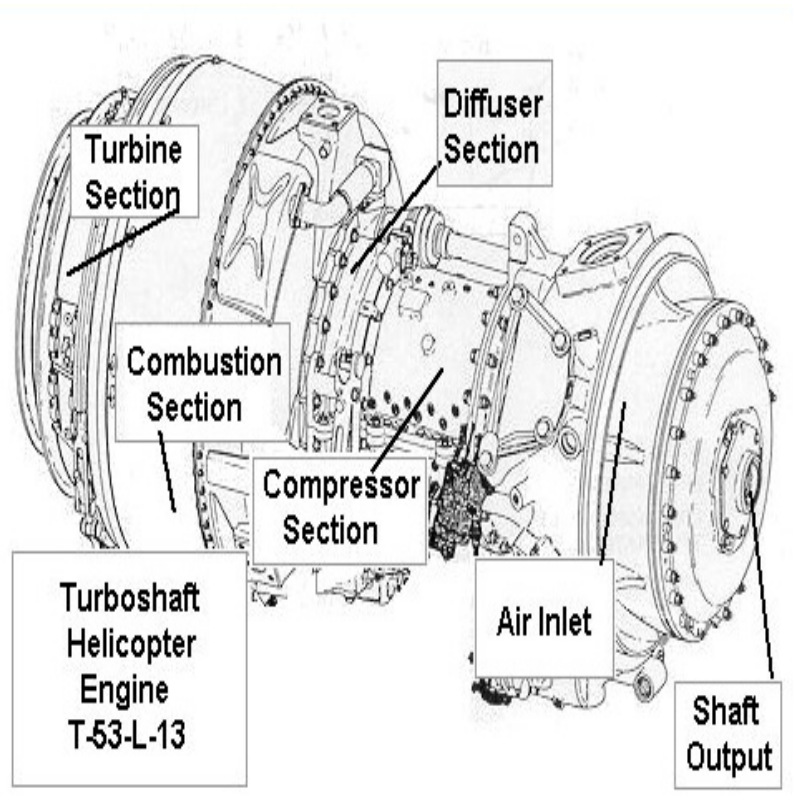
- Conversion into drive power to drive a transmission, as in most helicopters, refers to turbo shaft engine.

- Conversion into enough power to drive the compressor, and the rest being used as thrust, is turbojet (or thrust producing) engine.

Conclusion

Flying an Apache into battle is extremely traitorous, but since it is a deadly combination of strength, agility and firepower, it is a challenging opponent to almost everything else on the battlefield.

‘COMANCHE’ is a new revolutionary helicopter being developed by the U.S., which has several superior techniques, which is still under construction. So, for now, the ‘APACHE’ holds the first position among the radical helicopters.



Adaptive Brake System

-By Mihir Naik (TE Mech A)

Introduction

Adaptive Braking System refers to a number of devices designed to avoid wheel lock during hard and unexpected braking conditions. These systems gained the attention of the world just five years ago, but even the simplest system provides huge gains over electro-mechanical systems. Four wheel systems provide more security with both steerability and stability ABS systems are designed around system hydraulics, sensors and control electronics. These systems are dependent on each other and the varying system components are interchangeable with minor alterations in the controller software.

Structure and Functioning

The Adaptive Brake System assists the driver in dangerous situation which could occur at any random instance thus enhancing the safety.
For its functioning the ESP (Electronic Stability Program) plays an important role.
For its optimal functioning the ESP control unit takes data from the following component to analysis the current driving situation and act accordingly.

1. Left front axle RPM sensor.
2. Right front axle RPM sensor.
3. Left rear axle RPM sensor.
4. Right rear axle RPM sensor.
5. Steering wheel angle sensor.
6. Stop lamp switch.

The entire Adaptive brake System consists or performs the following sub-functions:

1. Electronic Stability Program.

ESP prevents the vehicle from moving away from the course specified by the driver under oversteer or understeer conditions. This is maintained so by applying necessary individual braking force to each tyre to correct the deviations.

2.Adaptive Brake Light Flashing.

In an emergency situation, when the driver applies sudden brake the ESP control unit send appropriate signals to the designated control unit which actuates the left rear lamp unit, the right rear lamp unit a and the center brake lamp at a frequency of 5 hertz.

3. Dry Braking

In wet driving conditions it is essential for the brakes to be in their optimal condition, for this the brake pads are cyclically applied with a pressure of 1 bar for a short time (approx 0.5 sec) to remove the water from the brake disk. This improves the response time for Braking.

4. Brake Precharging

Upon the detection of an emergency braking situation, the brake Pads are brought closer to the disks. This is actuated on the basis of Sudden foot removal off the acceleration pedal. This compensates For the drivers response time and hence a shorter braking distance Is achieved.

5. HOLD function

For the ease of driver in traffic situation HOLD function helps the driver to relive his braking foot of the pedal by holding the brake. This is actuated by pushing the brake pedal twice after coming to a standstill, and can be disengaged by either pushing the brake pedal or the acceleration pedal.

6. EBD (Electronic Brake Force Distribution)

The EBD function provides assistance when the driver applies Medium force to the brake pedal preventing over braking of the rear axle and increases vehicle stability when braking in a curve by pressure at the rear wheel on the inside of the curve or increasing it at the front wheel on the outside of the curve as and when required.

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7. Torque Vectoring Brake

Torque vectoring brake actuates over the yaw angle values on the rear axle through intervention by the brake system. While cornering, a short intervention in the braking system by this function helps in the rotation of the vehicle resulting in precise and easy steering leading to better responsiveness and driving safety.

8. Anti Brake Locking System (ABS)

This function prevent the locking of wheels during an emergency braking situation and allows the steerability of the vehicle thus improving its stability and safety. The ABS calculated and provides the required optimal braking force to each wheel individually to avoid locking. If the ABS observes any locking within the wheels, the wheel is released from the applied braking force and is run under the inertial influence of the vehicle.

9. Brake Assist System PLUS (BAS PLUS)

BAS PLUS is an advance iteration of BAS. In this the control unit increases the brake pressure depending on the speed of the brake pedal operation and the distance of the vehicle driving in front.

10. Hill Start Assist Function

The hill start assist prevent the vehicle from rolling back opposite the travel direction of the engaged gear during the time the driver takes his foot of the brake pedal and puts it on the acceleration pedal.

11. Downhill Speed Regulation (DSR)

DSR provides the driver with the ease of control over the vehicle in steep terrain. The DSR speed setting can be set in a range of 4 kmph to 18 kmph. The DSR will disengage as soon as it senses any inputfrom the driver.

12. Cross Wind Assist

In the event of strong crosswind, the crosswind assist function assist the driver by minimizing the vehicle's yaw movement and correcting the track offset. The ESP control unit play and vital function in this case.

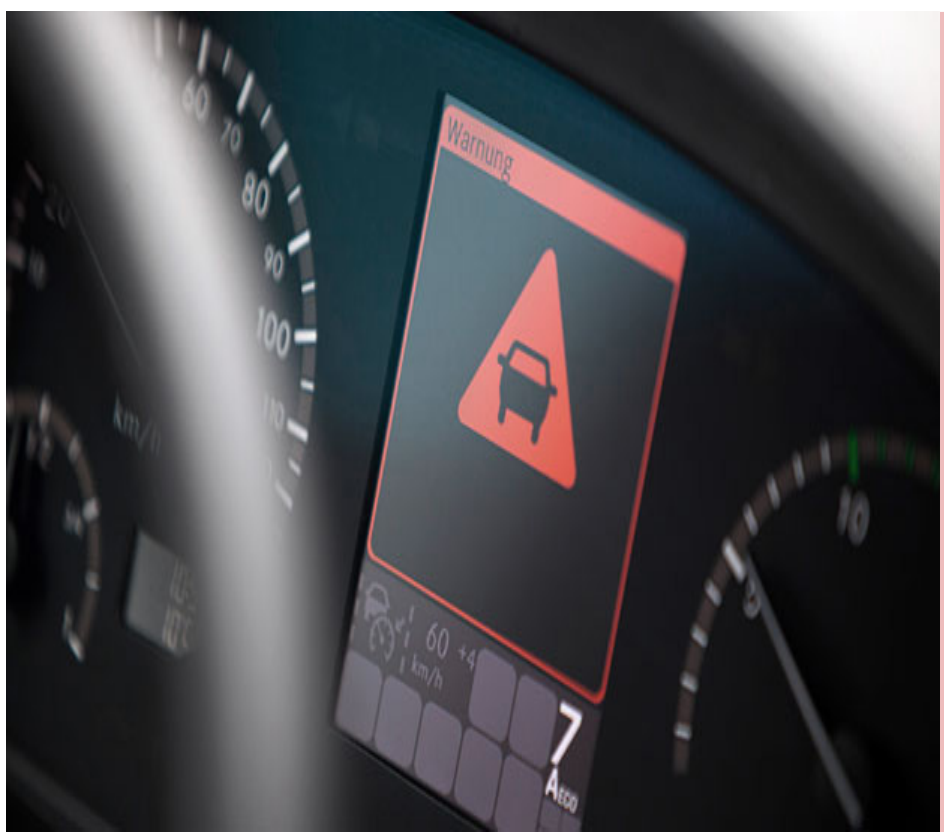
It rectifies the track offset by applying correct and appropriate braking pressure to the concerned wheel.

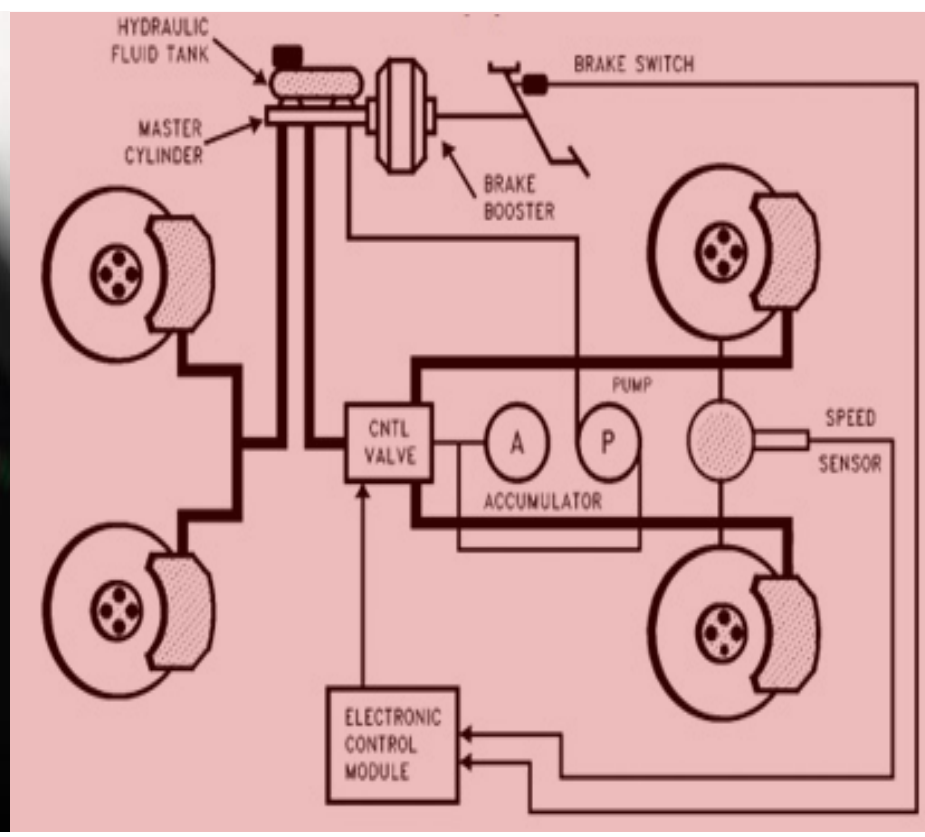
Designing Challenges

1. Making a system adjustable to variable wheel speeds for all the tyres individually.
2. Maximize fault tolerance and real time diagnostics for sensor, actuator and internal electronic faults.
3. In order to reduce size for mounting in very compact locations, integration must be optimized. This must be accomplished without a major impact on system cost.
4. All components used in control systems must be capable of operation at ambient temperatures ranging from -40^{0}C to 125^{0}C.

Conclusion

The Adaptive Braking System is an ever-growing promising technology that yet has scope of improvisation and development. Its features and efficiency are being worked upon by increasing the complexity of its layout.





Omni-directional Obstacle Detection

-By Ansari Basit Ali (BE Mech B)

Introduction

It is indispensable to detect the obstacles and free space for locomotion of the mobile robot in a real-world environment. Recently, vision-based environment detection methods have been actively developed in robot vision. The vision system can provide not only a huge amount of information but also colour information in the populated environment. Currently, because the omnidirectional vision system supplies a wide view of 360 degrees, they have been popularly used in many applications such as the motion estimation, environment recognition, localization, and navigation of a mobile robot.

There are several research papers about mobile robots for the purpose of baggage handling, surveillance work or robotic item like mice. These mobile robots are classified as nonholonomic mobile robots (which cannot move in all directions. For example, cars that have steering and driving wheels) and holonomic mobile robots (which can move in all directions). These holonomic mobile robots (also known as Omni-directional robots) are generally used in indoor applications because they can move in all directions and in narrow space without turning. Hence it is necessary to detect obstacles around them which can be done by sensors. For example image processing using CCD (charge-coupled device) cameras, ultrasonic wave sensor systems. However, the resolution from the latter is low.

Principle

The concept applied here is based on the method of triangulation. A laser beam is projected to the obstacle by a unit and the laser spot or slit in the obstacle can be detected by a Charge Coupled Device (CCD) camera. The calculation of (φ) can be done by using an image of CCD camera by obtaining the distance (x) between the laser unit and the obstacle by the formula –

$$x = h / \tan\varphi$$

Obstacle detecting system

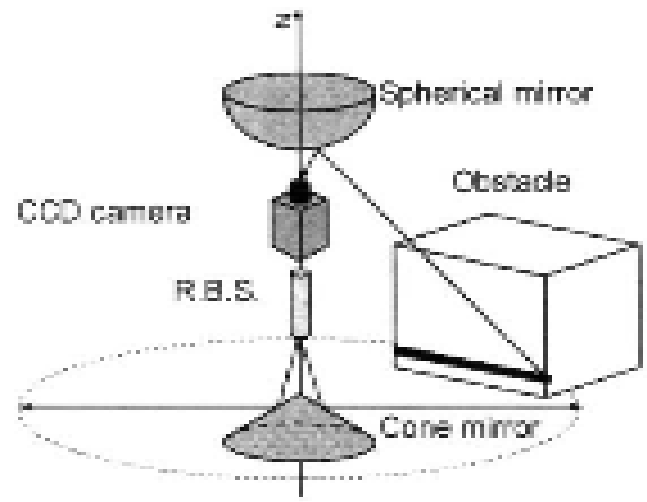
The ring beam projected from RES reflects at the cone mirror and the bright line on the obstacles is detected by the CCD camera via the spherical mirror. All the parts of the system are fixed and it can detect all obstacles around this system simultaneously.

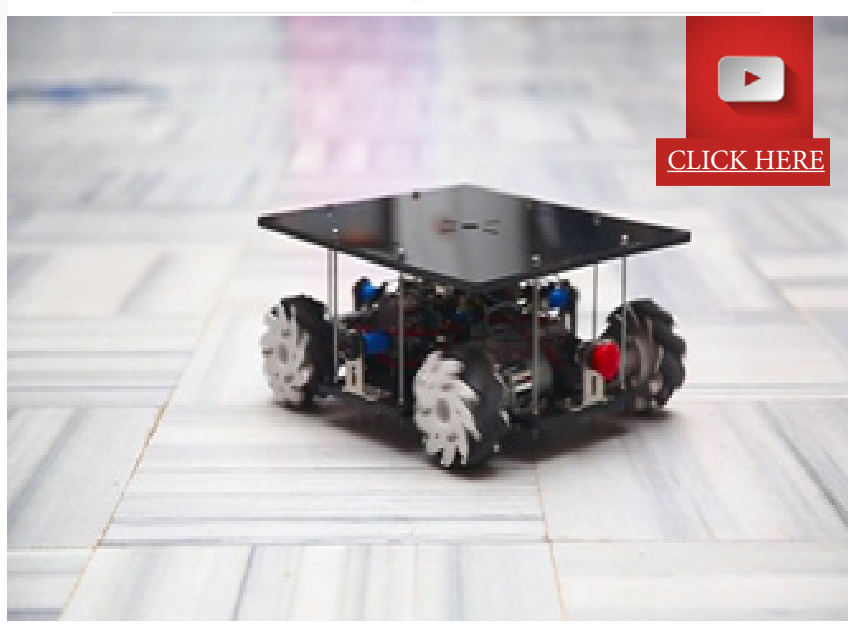
This article proposes a novel obstacle detection system using RBS (ring beam system), a spherical mirror and a CCD camera for indoor used mobile robots. A basic experiment was done to measure the distance of obstacle inside the box with sides 300mm. the colour of the box was kept white and the system was fixed at the centre of the bottom of the box. The result of the experiment showed the possibility of detecting an obstacle in the system; however the maximum measuring error was 15.4mm. Hence system was modified considering all the errors for example - the length between the CCD camera and the spherical mirror. And after the determination of all the parameters through geometric model, the result concluded as:

- The developed system can detect obstacles around this system simultaneously
- The error of the distance measured by this system is almost within the theoretical resolution.

Conclusion

In case of rotation of a mobile robot, the size and direction of optical flows were only used to detect moving objects. The moving obstacle was detected through the relative evaluation of optical flows. Especially, the filtering was suggested to eliminate the noise sensitivity of optical flow. Moving forward it will be necessary to reduce the vibration of mobile robots.





Non-Newtonian Fluid Speed Bumps

-By Kalpesh Maurya, Rounak Munoyat, Pranav Mody, Rahib Noor (SE Mech A)

Introduction

Speed bumps (or speed breakers) is the common name for the family of traffic controlling devices that use vertical deflection to slow motor-vehicle traffic in order to improve safety conditions. Variations include the speed bump, speed cushion, and speed table. The use of vertical deflection devices is widespread around the world, and they are most commonly found to enforce a low-speed limit. Although speed bumps are effective in keeping vehicle speeds down, their use is sometimes controversial—as they can increase traffic noise, may damage vehicles if traversed at high speeds, and slow emergency vehicles. Poorly-designed speed bumps that stand too tall or with too-sharp an angle can be disruptive for drivers and may be difficult to navigate for vehicles with low ground clearance, even at very low speeds. Many sports cars have this problem with such speed bumps. Speed bumps can also pose serious hazards to motorcyclists and bicyclists if they are not clearly visible, though in some cases a small cut across the bump allows those vehicles to traverse without impediment.

This Intelligent Speed Bump (BIV) is based in Non-Newtonian fluids dynamics in which particles in natural movement as liquid align when receiving an impact, thus entering into a solid state. This fluid is also biodegradable and harmless for human beings. This fluid inside the BIV is the solution to vehicles at sensible speed that will find no obstacle when driving over it.

Principle

A non-Newtonian fluid is a fluid that does not follow Newton's Law of Viscosity. Newton's viscosity law states that the shear stress between adjacent fluid layers is proportional to the velocity gradients between the two layers. The ratio of shear stress to shear rate is a constant, for a given temperature and pressure, and is defined as the viscosity or coefficient of viscosity. Most commonly, the viscosity (the gradual deformation by shear or tensile stresses) of non-Newtonian fluids is dependent on shear rate or shear rate history. Some non-Newtonian fluids with shear-independent viscosity, however, still exhibit normal stress-differences or other non-Newtonian behavior. Many salt solutions and molten polymers are non-Newtonian fluids, as are many commonly found substances such as ketchup, custard, toothpaste, starch suspensions, maize, honey, paint, blood, and shampoo.

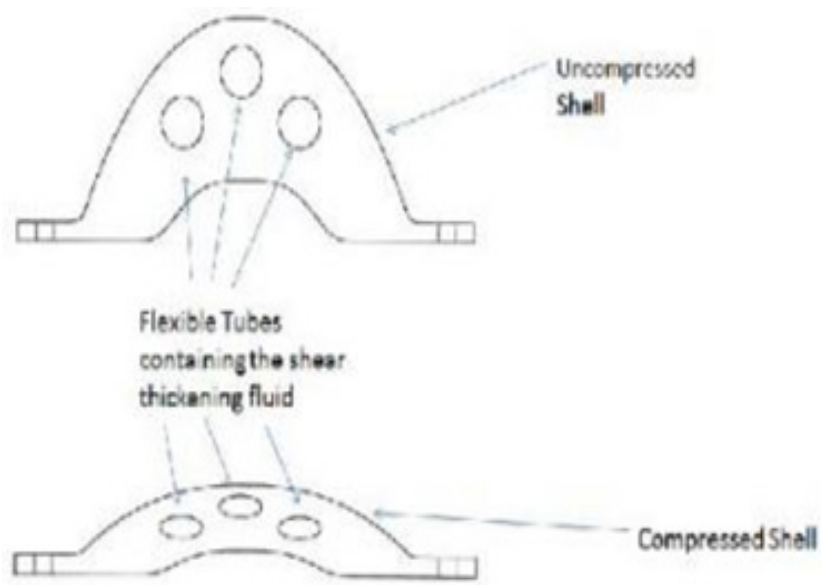
Non-Newtonian fluid speed bump is made using a casing in which the fluid is contained with no leakage etc. and is filled 95% to the full capacity of the containment so that when the vehicle is moving smoothly in accordance to the speed limit the liquid could be displaced and vehicle can pass over smoothly. But, if the vehicle moves with higher speed it will experience hard contact with the speed bump.

Design

The speed bump includes an outer shell and a bottom plate. The bottom plate may include one or more fastening holes so that the device can be either permanently or temporarily mounted to a roadway or other surface such as by bolts, screws, or other conventional devices. The shell can be formed of any conventional material, such as but not limited to flexible or resilient materials including or rubber The shell encloses one or more housings containing a compliant material such as a Non Newtonian fluid, which reversibly hardens or stiffens in response to an applied pressure and goes back to its original form when the pressure is relieved. The housings are in the form of elongated, hollow, flexible tubes having closed ends. The tubes are made up of either polymeric or rubber material. The flexible tubes are filled with a fluid and interconnected by a conduit which enables the controlled flow of the fluid in or out of the chamber If the vehicle travels at a reduced speed, fluid is moved to the adjacent chamber and a depression of the strip occurs in the area in which the wheels pass over, forming a small obstacle to the passage of the vehicle.

However, if the speed of the vehicle is high then the fluid has no time to pass into the adjacent chambers and a considerably smaller depression occurs. Hence, the strip forms a step with greater height, causing the vehicle to jump, warning the driver about his excess speed.

At high shear rates, the hydrodynamic forces overcome the repulsive inter-particle forces, forming silica hydro-clusters which increase the viscosity of the fluid. Therefore, the non-Newtonian fluid itself acts as means for controlling the resistance offered by the strip to its



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deformation depending on the speed of impact of the wheels of the vehicle on it. Thus, if the vehicle travels at a low speed the fluid has a low viscosity and the strip is easily deformed, whereas if the speed of the vehicle is high the viscosity of the fluid is high and as a result has great resistance to deformation, thus forming a rigid obstacle to the passage of the vehicle. Thus the speed of the vehicle is controlled due to the combined effect of non-Newtonian fluids and their flow via narrow conduits.

Working

The speed bump can be either permanently or temporarily mounted at a desired location, such as in a street or roadway. The dilatant material in the tubes can be selected based on a desired shear rate. The shear rate selected will correspond to a predetermined vehicle speed. When a vehicle rolls over the bump below the predetermined speed i.e. below the critical shear rate of the dilatant material, the dilatant material remains in fluid form and the weight of the vehicle compresses the shell and the tubes. This pushes the dilatant fluid out of the shell into the reservoir. When the vehicle has passed over the bump, the shell returns to its initial shape and the pump pushes the dilatant material back into the tubes which also return to their original shape. Thus, below the critical shear rate, little impact is felt by the driver. Therefore, if the vehicle is traveling under the selected speed limit which will provide a shear rate less than the critical shear rate.

However, in the event a vehicle impacts the speed bump at a speed above the predetermined speed that is, providing a shear rate above the critical shear rate, the viscosity of the dilatant material increases. The dilatant material acts as a solid and the speed bump substantially retains the speed bump shape. The speed bump in this scenario acts similarly to a conventional speed bump and the driver of the vehicle exceeding the selected speed limit will experience a bump or jolt as would be felt with a conventional speed bump.

Applications

- Safety equipments
- Speed bumps.
- Filling of potholes on high-speed roads.

Advantages Of Speed Bumps With Non-Newtonian Fluid

- All emergency vehicles won't be required to slow down at these speed bumps.
- In normal speed bumps the bus drivers and truck drivers get backache while again and again going on the bumps, this problem can also be solved using speed bumps with non-Newtonian fluid.
- Installation time is quick.
- Maintenance is low.
- Reduces the possibility of traffic accidents.
- Reduces fatigue caused to the shock absorbers.
- Reduces pollution, fuel consumption.
- And noise pollution caused by continuous bumping can be minimized.
- Simple manufacturing and fast manufacturing.

Future Scope

Non-Newtonian fluid can be used in many traditional methods of working we use today so that we can overcome various problems we face today
In safety equipment (e.g. Working Jackets, Machine Mount, Damping device, Fluid Dampers).

Conclusion

The Variable Density Speed Bump can help in increasing the fuel efficiency of vehicles up to a large extent. Vehicles need not come to a complete halt in form of speed bumps, reducing traffic congestion also. It also does not take a toll on a vehicle's mechanical components, such as the shock absorbers and steering system if the vehicle is following the speed limit. The setup is completely mobile and can be installed within an hour. The installation process does not require a technically skilled person

Carbon Fiber Reinforced Polymer (CFRP)

-By Harshal Tanawade (SE Mech B)

Introduction

Carbon Fiber Reinforced Polymer (CFRP) or often simply referred to as Carbon Fiber is a very strong and light fiber-reinforced polymer which contains carbon fiber as reinforcement. Carbon Fiber Reinforced Polymers (CFRP's) are composite materials. They consist of two phases: a matrix phase and a dispersed phase or also known as reinforcement. In CFRP's, a polymer resin acts as a reinforcement material. Hence, the CFRP formed has properties/characteristics of the materials included in making it.

Usually, a thermosetting resin such as epoxy is used as the binding polymer. But other than epoxy, thermoset or thermoplastic polymers like polyester, vinyl ester or nylon can be used sometimes. The final product's properties can also be affected by changing the type of additives introduced to the binding matrix (resin). The material is also referred to as Graphite-Reinforced Polymer or Graphite-Fiber Reinforced Polymer as it has carbon in the form of Graphite.

Properties/Characteristics

Being a Composite Material, CFRP includes two phases/parts: reinforcement and a matrix. A polymer resin is used to bind the reinforcements together which are made up of carbon-fibers which imparts strength to the composites. Since CFRP is made up of two distinct materials; the properties of CFRP depend on these two materials. specified by the driver under oversteer or understeer conditions. This is maintained so by applying necessary individual braking force to each tyre to correct the deviations.
CFRP has the following properties/characteristics:-

1. High Strength to Weight Ratio

It is one of the most important properties of CFRP, as there is a need for materials which are strong but light-weight. The strength of a material can be defined as the resistance offered by a material to breaking. The strength is higher running lengthwise rather than across the fiber, as the crystals of CFRP can orient in different directions. This is the reason; the designers specify the direction of orientation of fiber so as to increase the rigidity and strength.

2. Corrosion Resistance

CFRP themselves do not corrode. But, the matrix part which is made of Epoxy, is sensitive to sunlight especially UV Rays. So, it needs to be protected. Matrix phases, other than Epoxy, may also be affected by some external factor. Therefore, in order to protect the CFRP from internal corrosion, a protective coating must be applied to it. In case of epoxy, the protective coating is of external paints or varnishes to maximize damage from UV light.

3. Electrical Conductivity

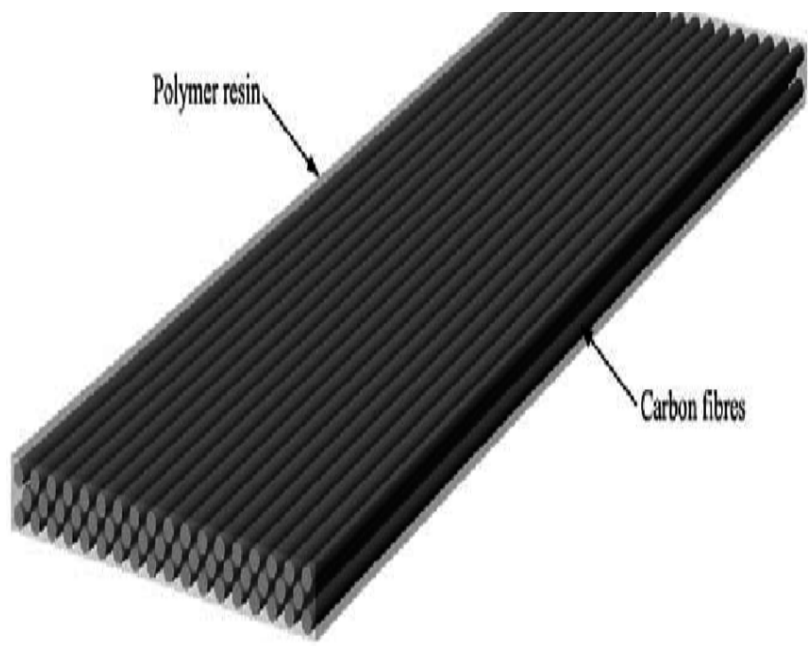
This property can be seen in CFRP's which have reinforcement material in the form of Carbon-Nanotubes (CNT's). As CNT's have excellent electrical conductivity, the CFRP also has similar electrical properties. Although, while using with Aluminum, special care has to be taken in order to prevent Galvanic Corrosion. But, research is still in progress to improve the electrical conductivity of CFRP.

4. Rigidity

The rigidity of a material is defined as the measurement of material's ability to resist deflection when subjected to load. It is also called as Stiffness of a Material. It is measured by the material's Young's Modulus. CFRP is over 4 times stiffer than Glass-Reinforced Plastics, 2 times than Aluminum and almost 20 times more than Pine. This property of CFRP makes it possible for its use in a wide range of applications in many fields.

Manufacturing Process

A precursor polymer like PAN (Polyacrylonitrile), rayon or petroleum pitch is used to produce the primary element required for CFRP. The precursor is first spun into filament yarns, then by using chemical & mechanical processes to initially align the polymer chains in such a way to improve the final physical properties of CFRP. Different Manufacturers use different compositions of precursor and mechanical processes used for spinning of filament yarns. After this spinning process, carbonization takes place wherein heating of polymer filament takes place to remove non-carbon atoms from it, thus producing the final product of carbon fiber. From these fibers, unidirectional sheets are formed which are stacked on each other in a quasi-isotropic layup.



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The CFRP making processes depends on the following factors such as: what kind of pieces are being made, how much outside gloss is required and how many number of pieces are to be produced.

Different Manufacturing Processes for Manufacturing CFRP includes:

1. Molding

In this method, CFRP parts are made by stacking layers of carbon fiber cloth into a mold in the shape of the required final product. In order to improve the properties of CFRP like strength and stiffness, the alignment and weave of cloth fibers is done carefully. After this, the mold is filled with epoxy and is either heated or air-cured for the final formation of the CFRP part. The final product is highly resistant to corrosion, with high strength-to-weight ratio and stiff. Parts which are used in very less critical areas are produced by draping cloth over a mold, with epoxy either impregnated into the fibers (a.k.a "pre-preg") or "painted" over it.

2. Vacuum Bagging

This method is used when few copies of simple pieces are required to be made (about 1-2 per day). A mold made either of fibreglass, carbon fiber or aluminum is polished and waxed, and has a release agent applied before the fabric and resin are applied. Then the vacuum is pulled and set aside to allow the piece to harden. There are 3 different ways to apply resin to fabric in a vacuum mold: first method is called as "Wet Layup", where the two-part resin is mixed and applied before being laid in the mold and placed in the bag; second method is done by infusion, in which the dry fabric and mold are placed inside the bag while the vacuum pulls the resin through a small tube into the bag, then through a tube with holes to evenly spread the resin throughout the fabric; the third method is called as "Dry Layup", in this process carbon fiber is already impregnated with resin applied to resin, then it is placed in a vacuum to cure. The dry layup method is different than wet layup as it has the least amount of resin waste and can achieve lighter constructions.

3. Compression Molding

It is a quicker method among other manufacturing methods, in which a two-piece mold usually made of either aluminum or steel is used to press the fabric and resin together between it. As said earlier, its main perk is the speed of the process as some of the car manufacturers have claimed to be able to make a new part every 80 seconds. However, the main drawback of this method is its high initial cost since the molds require high precision CNC machining.

4. Filament Winding

It is a method which is used for making shapes which are difficult to produce using traditional molding or vacuum bagging process and have convoluted profiles. CFRP is made using Filament Winder which winds filaments around a mandrel or core which has the shape of the final product.

Applications

Due to its unique properties, CFRP has applications in various fields. They include:

1. Aerospace Engineering

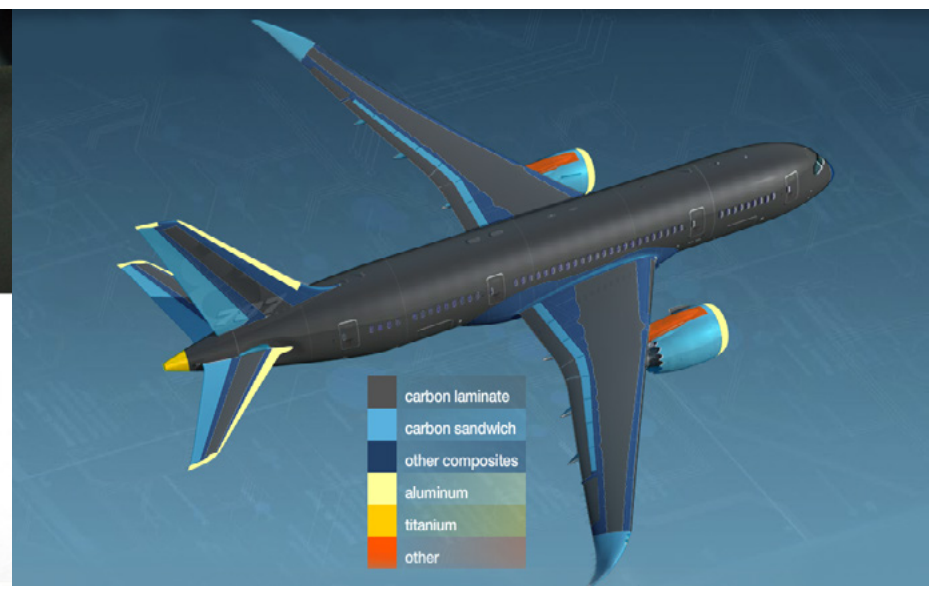
The central wing-box of the Airbus A380 was made of CFRP and it was the first Commercial Airlines to make use of CFRP technology. Also, it was the first to have a smoothly contoured wing cross-section, which optimizes aerodynamic efficiency. Today, the Airbus A350 XWB is built of 52% CFRP including wing spars and fuselage components. CFRP is also used for spacecraft and micro air vehicles (MAV) due to its high strength to weight ratio and corrosion resistance.

2. Automotive Engineering

High-End Automobile Racing makes use of CFRP extensively due to its high strength-to-weight ratio. Manufacturers of race cars have developed methods to give carbon fiber pieces strength in a particular direction so as to make it stronger in the direction of the load being applied. While Manufacturers have also developed carbon fiber whose applied strength is Omni-directional i.e. in all the direction.

3. Civil Engineering

In Structural Engineering, CFRP has become a notable material again due to its properties like Corrosion resistance and high strength-to-weight ratio. Besides these properties, CFRP also has proved to be cost-effective in a number of construction applications such as for strengthening concrete, masonry, steel and timber structures. CFRP's main role in this industry is either to strengthen an existing structure (known as Retrofitting) or to act as an alternative reinforcing material instead of steel.



4. Sports Industry

Nowadays, CFRP is used in wide range of sports equipments such as in racquets used in Badminton, Tennis, Squash, Arrow shafts, Hockey sticks, Fishing rods, Surfboards, High end swim fins and rowing shells. CFRP is also used to make bicycle frames, as it has high strength-to-weight than any of the steel, aluminum or titanium. Again the stiffness of CFRP can be increased in a particular direction by arranging the orientation of carbon-fiber weave.

5. Other Industries

The polymers and thermo-set composites can be made fire resistant if a thin carbon fibers layer is molded near the surface of the polymer, as it will efficiently reflect heat. Musical instruments like guitar picks, drum shells, violin bows, bagpipe chanters, etc. are made using CFRP. Bodies of drones, rotor blades of helicopters, tripod legs, tent poles, fishing rod, laptop shells, etc. are made using CFRP.

Advantages

- High Strength-to-Weight Ratio.
- High Stiffness.
- Longer Durability.
- High Corrosion Resistance.
- High Vibration Resistance.
- High Radiolucency.
- X-Ray Transparency.
- Thermal and Electrical Conductivity.
- Low Coefficient of Thermal Expansion.

Limitations

- Making a Mold for CFRP is not easy as it often requires a specialist.
- It is Expensive.
- Once cracked it has to be replaced by a new one.
- Time of production is comparatively high.
- The disposal of CFRP is a bit problematic as of now the recycling technique for cfrp has not been discovered .
- It is Brittle.

Conclusion and Future Scope

This article has explored various topics related to CFRP such as its properties, manufacturing techniques, applications, advantages, and limitations. The CFRP is still a new topic and so there is still a lot of research yet to be conducted regarding how to enhance its properties more efficiently, how to manufacture using different kinds of modern technologies, how to overcome its limitations and mainly how to properly recycle it so that it does not affect the environment.

IMAGINE
DESIGN
BUILD
RACE

ASME HPVC
(Human Powered Vehicle Challenge)

Human-powered transport is often the only type available in underdeveloped or inaccessible parts of the world, and if well designed, can be an increasingly viable form of sustainable transportation.

The HPVC provides an opportunity for students to demonstrate the application of sound engineering design principles in the development of sustainable and practical transportation alternatives. Students work in teams to design and build efficient, highly engineered vehicles for everyday use—from commuting to work, to carrying goods to market.

The first stage of the competition involves the preparation of a comprehensive design report. The second part includes a demonstration of a technical innovation included in the design, a speed event (either 100 meter flying start time trial or head-to-head drag race) and a 2.5-hour endurance race held over the course of a weekend. Guidelines and more detailed requirements (including safety measures and tests) can be found in the full competition rules.

The Team

Team Photon of the Thakur College of Engineering and Technology is the premiere team from the institute to participate in the ASME HPVC Asia Pacific Level competition. The team has twice been a participant of the aforementioned competition. The HPVC 2017 competition was held at LNMIIT, Jaipur in the month of March meanwhile the 2018 one was held at DTU, Delhi around the same month. In our first attempt a total of 20 members contributed to our team effort. The number increased to 28 during our second attempt.

Motive to Participate:

a) To showcase our skills at a national level.
b) To create something that can help the society in numerous ways.
c) To know where we stand in this era of engineering advancements.
d) To apply our theoretical knowledge into something practical.

The Process:

i. Deciding the material, budget, design:

The first and foremost challenge that we faced during the design stage during our first attempt at the competition, was the selection of the material. There were hundreds of materials that we could have chosen for our vehicle, but after a school of thought coupled with rigorous research we decided to go with Aluminum 6061-T6. This particular material peeked our interest due to its light weight and excellent mechanical properties. Also, the fabrication of this material was well within our estimated budget.

During our second attempt instead of using the same material as earlier we explored other possible alternatives and decided to gamble with Carbon Fiber. We have become the first team in the college to use a composite material for our vehicle. Carbon Fiber is 3 times stronger than steel and 4 times lighter than its counterpart. But its fabrication and assembly were to be done at Ahmedabad. We were willing to take this risk for the use of such a high-quality material that finds its application in the aerospace industry.Choosing the above-mentioned materials opened the door to new learning in terms of their machining and fabrication (which were not much known to us) along with
a wide set of challenges.

ii. Planning and manufacturing of the vehicle:

After the we finalized the material and design for our vehicle, it was time for us to decide our plan of action and the place of fabrication. Keeping our exams and competition dates in mind we finalized or action plan. Now it was time to get our hands dirty with the manufacturing part of the project.

For the fabrication (welding) of Aluminium 6061-T6 we locked our minds on a place in Malad West. Half way through the fabrication of the frame we realized that the welding being done was not welding at all. Being way behind schedule and the competition fast approaching we ignored this blunder and focused on completing the vehicle. Back then we were unaware of to the repercussions of that blunder which was to cause unimaginable heart break later on in the days to come.

Due to lack of knowledge and experience we wasted a lot of time, money as well as efforts and we barely finished our vehicle before the competition. We didn't even have time to test our vehicle let alone ride it. Second time around also the story was same. We decided upon a material (Carbon Fiber) that we had no prior experience or knowledge about. The difference was this time we agreed upon making a full-sized prototype of the actual vehicle before getting our hands on the wonder material 'Carbon Fiber'. Also, this time we started well before our previous attempt. But destiny had other plans and we lagged behind once it came our actual choice of material's fabrication and assembly. The trip to Ahmedabad which was supposed to last a week tops took a little more than 3 weeks of our time. Thus, our dream of testing the vehicle once again was flushed down the drain.

Our failures set aside the immense experience and knowledge that we gained during the two years of participation are sure to be a colossal factor in shaping the future engineers within us.

Lessons learnt:

Barely managing to complete the vehicle we arrived at Jaipur with a radiant glow in our eyes which was soon to turn into dismay. After arriving at the location and having allocated our work pits, we started to ready our vehicle for the competition. When the time came for the test drive, our vehicle frame shockingly fractured into two parts! We were heart broken. But, we had come too far to return without a fight. With determination and quick thinking, we fixed the vehicle to its former glory and passed the safety test. Just before the brake test our vehicle broke again. But we still weren't ready to give up. Once more we fixed the and passed the brake test with flying colors. After jumping through one hurdle we were met with another one just before the drag race event. Our transmission system gave up at which point we finally heavyheartedly gave up. The judges were proud of us for our determination and team work and showed us our mistakes.

The second time around we did ride on our vehicle for 2 days before competing in the competition. On the first day of the competition everything was going great until that evening the coupling in our steering mechanism broke and we had to weld it. As soon as we started welding the coupling the carbon fiber frame started to melt somewhere around the middle. A burning smell followed the phenomenon. We knew that our frame once again had fractured. After consulting with the judge, we came to know as to why the material failed at that particular spot. There might have been a blowhole or defect which caused a caused a rise in the temperature at that spot. Learning from our previous years mistake we solved the problem with teamwork and determination and the vehicle was up and running in time for the endurance race.

Both times we had committed the same mistake of not knowing much about the material that we had selected. The teams that won deserved to win because they designed it simple using standard components and material.

Experience:

Teams from all around India participated in the competition. Every team that had put their blood and sweat in making their vehicles. Every vehicle was unique in its own aspect. Everyone was filled with team spirit and enthusiasm. Teams helped their fellow contenders when they needed it, thus showing sportsmanship. The judges were also very welcoming and supportive. Overall the competition was very well organized. We left the competition with mixed emotions: glad because we learnt a lot of new things, met lot of new people, explored new engineering concepts; heavy hearted because despite our efforts we failed to fulfil our dream.

Performance improvement:

Comparing the two attempts of the competition we did improve on some grounds but we also repeated some of he same mistakes.

The mistakes that we repeated were:

a) Choosing a material of which we didn't have the resources or knowledge.
b) Lack of proper planning.
c) Lack of communication between teammates.
d) Lack of involvement of all the members.
e) No proper documentation was maintained.

We improved on the following aspects:

a) We managed to acquire sponsorship.
b) We created a prototype before fabricating the vehicle.
c) We made use of more standard parts.

Word of advice to potential team members:

1. Start early so that there would be ample time for making the vehicle.
2. Document each and every thing you discuss or decide.
3. Learn from previous mistakes and try not to repeat them.
4. Compare your vehicle with the achievers. Find out what they have different.
5. Ensure healthy communication among team members.
6. Research and find new ways to improve the design.


8


DOWN

The Hybrid Vehicle Challenge (HVC 2018) is organized by **IMPERIAL SOCIETY OF INNOVATIVE ENGINEERS (ISIE-INDIA)**. It was started 5 years ago and recently its name has been changed to Formula Imperial 2019.Formula Imperial is a student-oriented, formula style vehicle design and manufacturing event with the objective of designing and fabricating a hybrid or an electric vehicle under ISIE Design norms so as to give students the chance to demonstrate creativity and prove their engineering skills. Teams have to use a combination of an IC engine and an electric motor to run their hybrid vehicle.

The Team

The team was named Mavericks Racing. A maverick is an unorthodox, independent-minded person and we like to think that we are too. We started this team in June 2016, with the support of 26 members, which has increased to 32 members over time. We divided our team members into different domains, which are listed below:

1.Power-train System
2.Braking System
3.Suspension System
4.Chassis
5.Steering system
6.Sponsorship Team
7.Social Media Team
8.Documentation Team
Each domain has a Domain Head, who has 4-5 members working under him.

Motive to Participate:

While doing a project on RC Planes, we realized the importance of practical exposure, which is not included in our academic curriculum. It took us a year to get the plane flying but it was worth our time so we decided to participate in a national-level engineering competition. We researched various competitions on the internet and finally found HVC to be a perfect fit. It was different than other events and hybrid technology was and is a promising technology in commercial vehicles, so we decided to go for it.

The Process:

1. Selection of material:

It depends on the following factors**:**

1.Application
2.Different stresses that will act on it.
3.Weldability of the material
4.Availability in the market
5.Various mechanical properties such as Density, Tensile strength, Bending strength, Modulus of elasticity etc.
6.Cost of the material.

Another factor which plays a key role in deciding the material is Bending. A higher grade of Mild Steel provides better tensile strength and hence better reliability, but due to its high tensile and bending stress it becomes difficult to bend it and it becomes too costly and impractical to machine it also it would have to be machined using a CNC machine which would have added to the cost and complications.

2. Budget:

Deciding the budget is an integral part of designing. Before starting with the designing, the following points are to be considered:

1.The overall Material requirement for chassis, side, bottom and body panels.
2.Engine, motor and battery cost.
3.Already available components which are in a good condition and hence can be utilized.
4.Standardization of nuts and bolts.
5.Old components that can be purchased from the market at lower cost, for example- Tires, Shock-ups, etc.

3. Design:

This stage of the competition is something which decides whether one is capable of making a vehicle or not. If one does not perform well in this phase then they will be out of the competition.
Designing a vehicle is an enormous task. Each domain head along with his team members studied about that particular system, discussed the various design objectives, methods and goals.

Then, the components involved were identified. Their importance, design considerations and parameters that affect their design are some key factors which are to be considered. The next step is to calculate various stresses and decide the specifications of all the components. Those components are then designed in 'Solidworks' or 'Catia' and are then validated through analysis, using Ansys, Lotus or some other software.

All these designs and calculations were then presented in front of the Judges in the Virtual Round organized by the competition. They reviewed our design and suggested some modifications. After making all the necessary changes, we modified our design and started the manufacturing of the vehicle.

4. Planning and manufacturing the vehicle:

First, we made a GANT chart. In a Gant chart, various activities are planned with respect to time, keeping in mind important dates such as our university exams and the deadlines for various rounds of the competition.

Designing is the crucial part but manufacturing is completely different. It requires a high level of precision as even the minutest of error will change the entire vehicle configuration. Solving manufacturing related problems requires experience, a lot of research and guidance from experts. This part of the competition is very crucial, time-consuming and takes a lot of effort. Therefore, the team always tried to work in shifts during the manufacturing phase, under various domain heads, which saved time as well as improved the quality of our work. It took us over two months to manufacture the vehicle, we used to work for 12-14 hours daily during this period.

Experience:

It was a great experience designing and manufacturing a vehicle from scratch. Doing any national or international level projects teaches a lot of things as a lot of problems are faced during the journey like Technical, financial, team conflict, improper management of resources, unavailability of time etc. but a team member goes through all these problems and learns how to tackle them. All these things bring a lot of confidence and make them stronger.

In doing this project we interacted with other undergraduate students from different colleges from different cities and states which helps in developing good contacts. New teams always learn a lot of things from veteran teams, we even learned different technical stuff from KJ Somaiya's BAJA team REDSHIFT RACING INDIA. Overall it was a journey will lot of thrills.

Lessons Learnt:

In the first attempt, we worked very hard on design and aced it. We spent a lot of time in designing and we somehow cleared the virtual round with 14th rank out of 90 teams from all over India. But, due to improper management of time and the team, we ended with very less time for manufacturing. As we were doing this for the 1st time we didn't have any practical experience hence made a lot of mistakes in the fabrication of different parts such as Uprights or Knuckle, Wishbone. Also, we failed to fit the braking system as well as we weren't able to couple the engine and motor. All these shortcomings taught us a lot of things. These failures could have been avoided under proper guidence.

In our second attempt, we started afresh. We redesigned everything and this time our design was more detailed and close to perfect. Judges were impressed by our performance in the virtual round and this time we secured 6th Rank out of 100 teams.

This time we started the manufacturing in the slots of final exams. We used to work for 3-4 days in every gap of 5 days for exams. Doing so we completed our chassis manufacturing by the end of the exam. Then we just had 28 days to complete the vehicle, test it and to pack it for transportation. We tried very hard, team members worked during days as well as nights. Domain heads used to work for 24 hours for 3 days continuously. Everyone was tired, frustrated but still, everyone compromised their vacation and were fully dedicated to this vehicle. We completed the vehicle on the day of transportation and when we started our vehicle we were filled with a lot of energy, happiness and satisfaction. Everybody forgot the struggle, pains and the late nights and rejoiced.

A piece of advice

1.Always be an active member of the team. Try to do a lot of different things which are out of your comfort zone and only then you will discover yourself.
2.Learn Time management and team building.
3.Try to be calm in every situation, as everybody is young and passionate, tempers run high but calmness will always lead to a different and better solution.

Quad is an all-terrain vehicle (a four-wheeler bike), which was initially developed as a farm-to-town vehicle in isolated and mountainous areas.

"**Indian Society of New Era Engineers**" is an organization focusing on the technical and managerial development of future engineers. The organizing committee gives opportunities to the undergraduate and diploma engineers to research and develop innovative projects. Design challenges organized by ISNEE provide students a platform to work as a team and allows them to commit and dedicate to demonstrate and prove their creativity to resolve real-life problems.

Quad-Torc is a four-day competition which involves many events which are planned each day. The competition starts with a drop test event which is mandatory for all the teams to pass, the vehicle is dropped from a height of 6feet. Many other events such as the DisAsm, Suspension test, Manoeuvrability, Kill the Hill and other documentation events such as the Design Validation, Evaluation and Business plan presentation are conducted accordingly. The final stage of the competition includes a 4hour endurance race on the track to test the vehicles reliability.

Team Technocrats from Thakur College of Engineering & Technology participated in ISNEE QUAD-TORC national level competition. The Quad-Torc 2017 was held at Bijnor, Uttar Pradesh from 22nd-25th September 2017. The team initiated its journey by participating for the first time in 2017 with 20 members and will participate and show their improved skills in 2018 with a total of 30 team members.

Our motive to participate:

1. To showcase our skills at a national level.
2. To build a bridge between imagination and the real engineering through designing and manufacturing.
3. To create a change in the society with our knowledge of engineering.

The Process:

1.Deciding the material, budget, design:

The most significant and challenging part as a team is to build a vehicle with high-quality components and also to maintain the budget. The work initiated with hundreds of iterations for suspension and steering mechanism to choose the best design and reliability for our vehicle. While participating for the first time the team was a bit confused about the material to be used and finalised Carbon Steel (AISI 1018) but for the second time the team is focused on weight reduction and is leaning towards Alloy Steel (AISI 4130) as it gives twice the strength as compared to its weight.

2.Planning and manufacturing the vehicle:

As we finalized our material and design, it was the time to have an efficient schedule for manufacturing. As we were new to this competition and lacked knowledge we decided to attend a workshop which was organized by ISNEE committee. It was a 3-day workshop in Bhopal which gave us a brief insight into our method and manufacturing techniques. The engine was a 250cc LIFAN engine provided by SD Motors. So, we decided to get our hands dirty at Badlapur where we had a place to work and a massive ground to test dynamically the vehicle at each stage.
This time it would be something different and we hope to inculcate our ideas as well.

Lessons Learnt:

We managed to complete our quad one night before the vehicle was to be transported. After arriving at the location, a day before the competition the team members were full of passion and enthusiasm, as the day arrived and we were allocated to our pits. The competition starts with the most stressful yet mandatory event known as the drop test where the vehicle is dropped from a height of 6feets and we managed to successfully pass the test. Day1 events went well till the time we noticed an issue in the braking mechanism at the end of the day.

And then it was Day 2 where suddenly we were unable to hear the sweet sound of our engine, we were all astonished and frightful at the same time but the team did not lose hope and we managed to resolve the problem and gave our best at the brake test and suspension test. On Day3 when everything was going fine the brake system suddenly stopped responding just before the Brake Test. And this gives us an immense feeling of pride as a team that the leaders always kept the positivity and encouragement of the team at its peak. Due to lack of knowledge and experience, it took us a lot of time to identify even a small problem like air bubbles present in the braking system which were later resolved by a bleeding process. Although the last day of the competition will be a memorable event because even a new and fresh team like us managed to complete a continuous 4-hour endurance race. The judges and inspectors were proud of us and did not forget to commend our passion and ability to solve the problems with team spirit.

This year learning from our past mistakes we hope to inculcate our work as a designing and manufacturing unit efficiently, as winning is our ultimate goal.

The Competition:

Fifty teams from all over the nation participated in this competition. Every team and their vehicle was unique in its own way and surprised everyone with their skills. The technical inspectors helped and guided each team throughout the competition. The competition was well organized and the members of other teams also helped each other with any spares or fabrication if needed hence showed sportsman spirit. Being the first team from our college we managed to gain some good numbers in terms of ranking and achievements.

1.Won the first prize in the photography competition.
2.Secured the second place in Business Plan presentation.
3.Finished sixth in the endurance race.
4.Bagged the 16th position on the overall rank chart.

Performance Improvements:

Participating for the first time many mistakes were made which we hope not to repeat the second time. As also when students are participating in such national level competitions the team had managed to plan and work entirely on our own.

Comparing the previous attempt, we improved on following aspects:

1.We managed to acquire sponsorship.
2.We are doing more iterations for better results.
3.We are making use of semi and self-fabricated parts to reduce weight and to gain more accuracy.

BAJA

The BAJA SAE Series is an event for the undergraduate engineering students, organized globally by the Society of Automotive Engineers, USA. The event originated in the name of Mini - BAJA, in the year 1976 at University of Carolina. Since then, the event has spanned across six countries – USA, Mexico, South Africa, Korea, Brazil and India. The BAJA SAE tasks the students to design, fabricate and validate a single seater four-wheeled off-road vehicle to take part in series of events spread over a course of 3 days that test the vehicle for the sound engineering practices that have gone into it, the agility of the vehicle in terms of gradeability, speed, acceleration and manoeuvrability characteristics and finally its ability to endure that back-breaking durability test.

Event Highlights-

- Over 400 teams registered for the virtual round.
- 388 teams comprising up to 26 members each from different colleges in India participated in virtual round held at Chitkara University, Punjab.
- 180 teams selected for main dynamic events to be held at IIT Ropar and Pitampura.
- Largest engineering design and manufacture event for vehicles for students in India.
- Attended by over 30,000 students annually.
- Heads and important delegates from major automotive firms like Mahindra, Briggs and Stratton etc attend the event.

The Team

- Team Mavericks Racing, is a student team of TCET, Kandivali that develops prototype race vehicles and is representing TCET in SAE INDIA BAJA 2018, the largest event of its kind for undergraduate engineering students in India.

- We are a team of dedicated students taking care of project planning, management and execution involving car design, fabrication and testing.

- Each member contributes towards the team in his specialized area of interest. The team has been divided on this basis into five subdomains-Powertrain, Suspension, Chassis, Brakes and Steering each headed by a senior team member.

- To serve the purpose of testing the skills learned by students in college and challenge themselves with a real-world engineering problem, the team has developed an off-road ATV capable of tackling really harsh terrain at high speeds.

- The team consists of 16 members, 6 from the final year and 10 from the third year.

Motive to participate

SAE BAJA, India is the largest event of its kind where students design and then manufacture an all-terrain vehicle. With over 500 teams participating in the virtual round it would be an extremely difficult task to compete in the final event. We would be competing against teams having experience of over a decade and budgets of over 10 lakhs. This level of difficulty inspired us to take a crack at the event and test ourselves at the highest level possible in India. The team wanted to increase their repertoire and had the confidence that they would be able to execute such a project.

The process:

Material:

As far as material handling is concerned we handled it in the following manner. For the chassis material, we selected the best grade of Mild Steel i.e. AISI 4130.Because this is an off-road vehicle, it faces bumps, mud, different terrain made from tires, bigger rocks etc. Therefore, this requires more strength in frames and more reliability as per practical and design consideration. Now for wheel assembly components like knuckle, hub and brake disc, we used EN 6. Due to its hardenability it is a much-preferred grade of MS.

Budget:

Since we were preparing for two competitions, the vehicles for both the competitions required the same wheel assembly. This saved 60,000 to 70,000 rupees which included material cost and machining cost. Also, wheel assembly was completely sponsored so we saved a lot of money here. Also, we bought a set of safety gears, where one complete set costed around 70,000. which includes Helmets (DOT and ECE or SNELL certified),
Balaklava, neck support, suit, gloves, inners and shoes (SFI rated). We used the a seat belt, seat and steering system components which cost around 50,000-55,000. Also, each team member of TE has contributed 17,000 which helped in registration, part purchasing like Engine and its components, tires, gearbox, suspension shock-ups, differential and most importantly transportation.

Design:

Designing a vehicle is an enormous task. Each domain head along with his team members studied about that particular system, discussed the various design objectives, methods and goals.Then, the components involved were identified. Their importance, design considerations and parameters that affect their design are some key factors which are to be considered. The next step is to calculate various stresses and decide the specifications of all the components. Those components are then designed in 'Solidworks' or 'Catia' and are then validated through analysis, using Ansys, Lotus or some other software.

Planning and manufacturing of the vehicle
The manufacturing of vehicle started from 23rd January. We had a month to complete the manufacturing of the vehicle. With proper time management, we completed this vehicle and tested it successfully.
Experience
It always feels very competitive to participate in national level events, because it shows where we stand among engineers of the same trade.
Mahindra organizes an aptitude test during the final event popularly known as BAJA APTITUDE TEST (BAT). If a student clears it, he may get a chance to opt for a personal interview in five companies of his/her choice. This section is always an attraction for every team.
Overall these events teach a lot to us. It builds contacts, gives the practical exposure, creates an opportunity for placements, provides a platform to compete with best engineers of the country.

Lessons Learnt:

Everyone in the team agrees that it was the single largest undertaking we have taken in our engineering careers yet. We have learned immensely in the fields of project planning, designing of a product, financial planning and execution and logistic planning. The team was divided into subdomains and the team members have learned a lot in their own subsystems and now have their own area of specialization. The nuances of what we learned would be too large for the purposes of this article. However, it can be said that what we have learned from this event single handed has propelled us to a point where we are each confident and capable of entering today's competitive market. It opened our minds to think differently and to find out problems and find solutions for it.

In our first event, we were far from perfect but we managed to compete at the final event successfully with a running vehicle. We have brought home a lot of learnings which we are eager to share with the next set of students who will undertake this task. It will be an even more challenging task for next year's team who will have to immediately start design iterations and testing to compete with the top teams.
A piece of advice

This project gives the experience of life, the real-world problems come in picture. So, team members should not take it just as a project but they should treat it as a product. Making a project and product are two different things. When we are just making the project, we don't spend much time in quality, ergonomics and cost. But as a product, we have to look at all aspects.

Every team member is equally important as that of captain. A captain is elected for the proper functioning of the team. Every team member should act individually but should always communicate to others very effectively. This helps in preventing any problem in manufacturing and as well as in design.Active participation is the key to win. If every team member is actively doing their work then we can save a lot of time which can be utilized in testing. One more advice is Productivity– This is a very important factor. Active participation is a good thing but productivity should be counted. People come to work for 8-10 hours but effective work hours is usually 3-4 hours. If we can improve this then the efficiency of the overall system can be improved.I always emphasize on management part, because engineers are best in technical part but still lot of projects fails every year due to improper management of Time, resources, machines and manpower. If a leader can manage above mentioned things, not sure about winning but failure can surely be avoided


GROUND TO GLORY
TEAM NAME
Mavericks Racing
COLLEGE NAME
Thakur College Of Engineering
And Technology
CAR NUMBER
53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INTERVIEWS

Herrenknecht India Pvt. Ltd.

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HERRENKNECHT
Tunnelvortriebstechnik

Industry: Heavy equipments

Established: 1975

Founder: Martin Herrenknecht

Headquarters: Germany

Products: Tunnel boring machines

1. Can you tell us about the Company and its operations?

Herrenknecht is the leading provider of holistic technical solutions in mechanized tunneling, building on the experience of more than 3,700 projects across the world. For all diameters, in all geologies and in all areas of application - railway, metro, road, utility, pipelines, hydropower, mining and exploration.

We offer our customers a complete portfolio of mechanized tunneling technology, additional equipment and services and therefore project-specific complete solutions. We call them "Full Range Solutions". Our focus is placed on clear value propositions, measurable benefits for the customer and team spirit.

2. Can you tell us about Herrenknecht India Pvt. Ltd.?

Herrenknecht India Pvt. Ltd, incorporated in 2007, is located on a 40,000 m² site in the outskirts of Chennai. The company has successfully implemented a quality management system and is now certified in accordance with ISO 9001. We have 2,250 m2 of Tunnel Boring Machine (TBM) assembly / rebuild facilities for up to 10 TBMs per annum, we also have Workshops for manufacturing of rock disc cutters and other cutting tools. In addition to this, we have a pool of 90 expatriates and Indian TBM specialists to guarantee the best possible services.

3. What skills do mechanical engineering students need to develop to become successful professionals?

Mechanical Engineering is dynamic in nature, so companies seek for people who can work across different disciplines with others, and continually adapt to new challenges. Good technical skills are essential. To prepare for a successful engineering career, you should focus on developing a variety of skills, including technical aptitude, theoretic knowledge, design knowledge, communication skills and intellectual curiosity.

4. How can the college help students to bridge the gap between the university-curriculum and the industry requirements?

The university must include courses to develop work-related skills in students. It would be good, if a course about the different types of work is introduced as a subject in the university/college curriculum. This will enable students to simultaneously perform practical training while they learn the theory concepts, in a more comprehensive manner.

5. What challenges lie ahead in terms of skill levels in India and the business environment?

There is a series of metro, road and rail tunnels, water and sewerage projects lined up for development across the country, in which a majority of tunnel projects are at various construction stages. Each project has its own set of challenges posed by the geological terrain, some of which can be complex and critical in nature. To overcome the challenges/problems encountered during the construction of tunnels, you require people with specialised skills to implement, optimize and maintain them.

"Herrenknecht provides mechanized tunneling technology for a wide range of infrastructure construction projects, namely metro, road, railway, pipelines, utility, hydropower, mining and exploration"

6.a What skills does a mechanical engineer require to work in each of the aforementioned sectors?

Mechanized tunneling is a challenging market which requires highly qualified personnel. At the same time, comprehensive technical expertise in various disciplines such as hydraulics, electrics or additional equipment is extremely important to understanding the entire tunneling process and provide optimum assistance.

6.b What challenges lie in each of these sectors?

The biggest challenge is to construct an appropriate type of Tunnel Boring Machine (TBM) for each sector, as each individual tunnel route in these sectors has a special geological and hydrogeological set of conditions. And to construct an appropriate machine type, each case is considered individually, after all parameters of the ground condition are considered

6.c How do the machines designed for each sector differ?

The most important basis for the planning and construction of a TBM is the knowledge about the characteristics of the sub soil. That is, the geotechnical and hydrogeological conditions, based on the ground quality report and characteristics in different and varying ground conditions allow our comprehensive project expertise/ engineers to make reliable recommendations about the appropriate type of Tunnel Boring Machine and Optimum TBM Design

7. What challenges do you face while executing/managing your projects?

The success of a tunneling project depends to a great extent on the knowledge about the subsurface conditions to be expected, the earlier interaction between ground conditions, site constraints and the tunneling method in the entire system. These parameters are considered while planning, which include arrangement of excavation tools, spare parts, machining specific conveying and tunnel lining installations, etc.

8. Your word of advice to students.

Success consists of going from failure to failure without loss of enthusiasm. Believe in yourself and all that you are. ***"Building the future together"***– is the motto of about 5,000 employees working in the Herrenknecht Group worldwide, in the implementation of innovative technologies.

AFCONS INFRASTRUCTURE LTD

GOPAL DEY
SR. MANAGER –MECHANICAL
AFCONS INFRASTRUCTURE LTD
CONSTRUCTION PLANT &
EQUIPMENT DEPARTMENT
VEERA DESAI ROAD, ANDHERI (W)
MUMBAI-400053

Industry: Infrastructure

Established: 1959

Projects completed: 350+

Landmark Projects:
Cruise Berth, Port Louis, Mauritius

Sulphur Expansion Jetty, Ruwais, Abu Dhabi.

1. Can you tell us about the Company and its operations?

Afcons is one of the leading infrastructure construction companies in India, and is among the top 15 marine construction companies in the world. We have executed turnkey megastructures involving innovative design and comprehensive construction services.

Since 1959, Afcons has delivered over 350 infrastructure projects across 15 countries in Africa, Middle East, CIS, South Asia and India.

We are present in multiple geographies across five verticals:

- Marine and Industrial – Jetties, Wet Basins, Dry Docks, Breakwater, Slipways, Wharves, Intake/ Outfalls
- Surface Transport – Highways, Bridges, Flyovers, Viaducts, Elevated Corridors
- Rail & Metro - Rail, Metro and Light Rail
- Oil & Gas – Offshore and Onshore
- Hydro & Underground – Tunnelling and Hydro works

2. Can you give us your brief introduction?

I am 'Gopal Dey', working with Afcons Infrastructure Ltd as a Sr. Manager in its Plant & Equipment Department. I did my Engineering from NIT Silchar, Post Graduation in Construction Management from NICMAR-Pune and MBA from SPJAIN Institute & Management Research –Mumbai.

I have more than 18 years of Experience working for Infrastructure Projects. In addition to this, we have a pool of 90 expatriates and Indian TBM specialists to guarantee the best possible services.

3. Can you describe your job to us?

At present I am working with 'Afcons Infrastructure Ltd' on its corporate office, for the past 15 years in the Plant & Equipment Department and coordinating for the following infrastructure projects:

i)Underground Metro Projects
ii)Industrial Projects
iii)Special Project (World Tallest Railway Arch Bridge Project across river Chenab)

In addition to this, provide technical support to the new and ongoing projects, also involve in the bidding process for various project.

4. What skills does a mechanical engineer need to possess to work in a construction company?

To work in the Construction Industry, one needs to have sound technical knowledge of the following subjects:

i) Automobile Engineering
ii) Fluid Mechanics
iii) Strength of Materials
iv) Thermodynamics
v) Theory of Machines
vi) Engineering Design
vii) Production Technology
viii) Air Conditioning & Refrigeration

In addition to possessing domain knowledge, having the following skills is very important:

i) Good Communication skills
ii) Being open to learn and innovative
iii) Good Interpersonal skills
iv) Good Analytical skills

5. What role does a mechanical engineer play in a construction company?

Mechanical Engineers play a very important role in all the construction companies across the world because nowadays most of the construction work is mechanised, because every project is time bound and requires a high standard of quality and safety.

These standards can be achieved only through mechanization, which means everything is dependent on the equipment, so to maintain its equipment fleet every company requires Mechanical Engineers.

6. What is the growth potential of a mechanical engineer in a construction company?

Mechanical Engineers with project execution knowledge would have a high growth potential in the construction organization.

7. What skills do mechanical engineering students need to develop to become successful professionals?

To become successful in the Mechanical Engineering Profession, one should have the following skills at the beginning:

i) Broad Domain Knowledge
ii) Good Communication Skills
iii) Core Competence
iv) Decision Making Skills
v) Awareness of the latest technology being used
vi) Knowledge of Industry
vii) A good understanding of Human Behaviour
viii) The skill to Inspire and Motivate others to give their best

8. How can students bridge the gap between the university-curriculum and industry requirements?

In my opinion, to bridge the gap between the University-curriculum and industry requirements, one has to undergo internship programs for a duration of two months at least, each year from the 3rd semester onwards, which will provide practical knowledge and understanding of the Industry requirements.

9. What kind of projects/orders do you hope to execute in the future?

I will prefer to keep work on underground metro projects because they are very challenging in nature.

10. What challenges do you face while executing/managing your projects?

While executing infrastructure projects, the main challenges are:

i) Land acquisition- Because of this, the design needs to be modified many times.
ii) Getting environmental clearance.
iii) Lack of Skilled Manpower
iv) Unforeseen Geology

11. Your concluding remarks and word of advice to students.

Infrastructure development is going to be a key element for human development for the next two to three decades in many parts of Africa, several Asian countries- particularly in India. The job creation, skill upgradation, productivity enhancement and creation of durable infrastructure for an aspiring nation is going to be a challenge as well as a huge opportunity for Engineers and Equipment manufacturers.

Students who are willing to work in the construction industry, should be ready to work in the challenging environment, which will provide growth in their professional carrier.


Students'
Projects

Mind's Eye-2018

Mind's Eye is an institute level project competition, where excellent projects of each department are exhibited. The projects are presented by the students to convince the audience, about how their projects justify the essence of innovation and how are they industrially fit. These projects are evaluated by judges from the industry, with respect to their technical credibility and soundness.

This year, 10 groups with outstanding projects where shortlisted for the competition, out of a total of 52 groups from the Fourth Year of Mechanical department.

1. **Aranyari- Adaptable bladeless disc wind turbine blades-1st Winner**
2. **Human transported cum forklift manufacturing plant- 2nd Winner**
3. **Waste plastic to diesel conversion- 3rd Winner**
4. **Change-over time reduction in press shop using SMED technique**
5. **Design and development if efficient pounding machine using lever**
6. **Design and prototyping of flapping wing turbine**
7. **Robot Vision using IP to perform various industrial application**
8. **Design and manufacture of personal transporter**
9. **Autonomous denim jeans painting robot**
10. **Speed control of energy conservation of electric car using inertia power, regenerative braking and solar energy**

Assessment of these projects was done by:

- Mr Umesh Gupta
  Director
  Bakelite electrical Mfg. Co. Pvt. Ltd.
  Kandivali West

- Mr. Anil Ambardekar
  President
  Vasai Industries Association

The judges announced the top three industry-worthy projects as winners for the Mind's Eye-2018, for the Department of Mechanical Engineering.

Adaptable Bladeless Disc Wind Turbine

-By Raj Oak, Meet Lakhani, Avinash Gupta (B.E Mech-A)

Abstract—Disc Wind Turbine is a development of a new design of a wind turbine which does not use traditional air foil sectioned blades. The research involves developing a turbine that uses three discs mountd along the periphery of the central hub in specific geometry and convert the kinetic energy of the wind, much more efficiently into rotational mechanical energy which could further be converted into electrical power. The working principle of this technology along with the experimental findings obtained by directly comparing our design with traditional wind turbine is further elaborated. Finally, various pitfalls of a traditional turbine designs are being discussed which are effectively lessened or eradicated in the Disc Turbine design. The design was developed realizing the fact that there is immense wind energy potential and the existing technology is only able to harness a part of it into a usable form.

Index Terms— Disc Turbine, Drag, Adaptation, Wind, Electricity, Reaction force, Wind speed sensor, Low RPM.

INTRODUCTION

Wind power is one of the perennial sources of energy along with being available during day time as well as at night time almost throughout the year which could be harnessed from most of the parts of the planet. But modern day wind turbines could convert only upto around 45 percent of the total energy content in the wind. Along with this the space constraints are a major concern in any developing or devel-oped country and this should be considered as one of the major factor when energy generation through wind power is at stake since wind energy generation requires a considera-ble amount of free space. Considering all these factors, Disc Turbine design is a new form of wind turbine, requiring less amount of space along with being able to convert most of the wind power into usable energy and minimize various difficulties associated with conventional wind turbine design related to on-field application. This design uses three disc shaped rotors along the central hub with adaptability depending on wind conditions by a servo mechanism. This is one of a kind unique design of a wind turbine which uses radically different concepts for wind power trapping and apt for increasing future energy demands.

DESCRIPTION

Wind energy is being used since a long time for generating useful work like cruising a ship through ocean to grinding grains in mills powered by wind to modern electrical energy generation by harnessing this immense wind power.

A conventional turbine uses an aerodynamic lift and reaction force generated while wind moves past each blade. These turbines generally have three blades with relatively smaller width compared to the length equally spaced from each other and have a large amount of unoccupied space between these blades. This is explainable since these conventional turbines generate power by the means of flow concept, which means that greater the velocity of wind flowing over these blades the greater will be the power generated, and hence if three blades, with relatively small width are designed then it would create less overall drag force and the wind could easily move with same speed over the blades. If the number of blades is increased to around six or ten then there would be a large drag force offered to the flowing wind and the velocity of the wind flowing past each blade would decrease and hence would develop less power along with increase in cost of additional blades and weight constraint.

Due to this a traditional turbine has small width of blades, in order to prohibit the decrease in the wind speed due to drag effect and letting most of the upcoming stream of wind to be passed over the blades and develop the motive power.

Disc Turbine utilizes the drag force which caused a prob-lem in the traditional turbine design as the main source for generating the motive power. Along with this, our design is capable of utilizing the reactive force generated by the wind while leaving the turbine blades, similar to the force generated by a jet of water leaving a nozzle.

LIMITIATIONS OF CURRENT DESIGN

The traditional design of the wind turbine is less efficient, consuming great amount of space and providing low output electrical energy. The cost of the entire wind farm project is very high and this could be the main reason for reluctance to most of the wind energy projects.

The manufacturing facilities required for construction of massive blades of turbine are not cost effective to build. The transportation cost involved in carrying huge and heavy machinery is high. Along with this the set up measures required to assemble the traditional wind turbine on site are quite cumbersome and involves a high amount of risk.

The blades of the turbine are made sharp to minimize the wind resistance, but these sharp edges take lives of thousands of migratory birds and bats all over the world .The allied cost involved with the traditional technologies like the cost involved in raw materials, manufacturing, labour, transportation and on site assembly are substantially high and this makes it less practical for implementation for any governmental or non-governmental organisation and are naturally gravitated towards the fossil fuel based energy source which are cheap but pernicious to our environment.

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Limitations of the traditional wind turbines are low torque for the given wind flow. These turbines are effective only when wind speeds are quite high, they are inefficient in low wind conditions. Some of the available designs harnessing low wind speeds are only capable of intercepting surface wind and hence are unable to capture full potential of the wind like the Invelox System.

HISTORY

In 2004 Shawn Frayne invented a bladeless wind energy harvesting technique which is based on the aeroelastic flutter of a polymer film held against the wind. The electrical energy is generated as the magnets attached at the ends of the polymer strip exibit a to and fro motion and electric current is induced in the copper coil held nearby .

In 2013 a startup Vortex Bladeless S.L presented a turbine with no blades which used a phenomenon called vortex shedding. This technology uses a fiber glass based column which sways in wind due to the vortices of air caused on either side due to its specific design and converts the linear motion into electrical energy .

A Tunisian startup Saphon Energy has developed a similar bladeless single disc designed turbine which converts wind energy into mechanical energy and then into hydraulic energy by pistons inside the hub. The hydraulic energy could be converted into usable electrical energy by a hydraulic motor. As the design uses single disc, it has a tendence to wobble and the structure starts shaking in high winds

DESIGN

Our design is inspired from the canopy of the umbrella and the sails of the ship. We realized that immense drag force is produced when the gust of the wind is obstructed by a specific geometry such as the canopy of an open umbrella. An umbrella held in the wrong direction against the wind could generate a huge amount of drag force enough to overturn the entire fragile umbrella structure. The sails of the wind work in a similar manner by trapping large portion of the wind flow and converting into drag force which inturn propels the ship further. By altering the angle of attack of the wind with respect to the sail, a component of the drag force could be utilized for changing the direction of ship. We combined the two concepts of um-brella canopy producing immense drag force and changing the angle of attack could make the drag component work in the required direction.

If this force component is made to work in a tangential direction with respect to a shaft attached to the central hub, then a torque could be produced. The turning moment depends upon the diameter of each disc and the length of the shaft. The speed of the turbine will depend on the velocity of wind flow.

Our bladeless design of the turbine consists of three circu-lar discs which are slightly concave or funnel shaped to-wards the wind facing direction. These three discs are fixed to a central hub by means of a connecting rod. All the three discs are mounted equally on the hub with 120 degrees angle between two consecutive discs. These three discs are given a certain angle so as to produce a tangential thrust effect required to generate rotary motion of the turbine. The preliminary prototype shown below is constructed with above specification as a proof of concept of our innovative turbine.

The actual turbine would have an electrical servo motor attachment in the central hub to equally change the angle with which each turbine is attached.

Another servo motor will be mounted on the whole generator turbine assembly in order to smartly adjust the front side of the turbine towards the wind direction or upstream direction. These servo motors would be using a small amount of electrical energy generated by turbine itself and smartly controlled by a microcontroller depending on the real time wind condition and the flow direction or directly through a base controller.

WORKING

Our design is inspired from one of the oldest source of wind energy harvesting technique which is the sail of a ship along with the shape of an umbrella. Sail ships are propelled by the huge drag force experienced by the massive sails which are kept at a certain angle with respect to direction of wind flow in order to steer the ship in the desired direction in the downstream of a wind current. Our turbine works in a similar way but allows the sails to rotate in order to obtain power, we are referring this technique as wind capture, and this will be discussed shortly. The another technology that we are using is the reactive force thrust generation, in which the wind when moves past the blades which are moving in relatively lesser speed than that of the wind impart some tangential reaction force while leaving the disc edge thus providing an extra moment towards the center.

Yet another technology, which in fact is a controlling technology that we are using, is the adaptable blade technology in which the angle of these blades relative to the central shaft will be automatically changed depending upon the wind conditions. All these three key techniques are further briefed below.

Same Center to Tip Distance

Wind Capture Technique

As mentioned earlier our design is largely inspired from sail of the ship. A sail of the ship is used to provide a motive power for the ship to move. When the sail is tilted along the direction of wind one side of the sail faces the wind directly on its frontal area than the other sides of the sail, due to this high pressure is created on the windward side than other sail sides and the sail gets a pushing force from high pressure side. In a sail ship due to the angle of the sail, some wind power is utilized in moving the ship forward and some power in moving the ship sidewise since the high pressure side generates almost a perpendicular force to the wind velocity, but a ship utilizes a stabilizers and long fins submerged under water which minimizes this lateral movement and only allows forward thrust. Our disc will perform in almost a similar manner with the change being, our design would utilize the lateral force generated when wind is imparted on the discs.

Due to the disc design, wind will impose a huge drag force in the direction of the wind; again as these discs are angled relative to the central shaft, this drag force now could be resolved into two components one tangential component and other simple pushing force. This tangential component acting at the end of the connecting rod where the disc will be mounted is the most important factor as it would provide a turning moment necessary to rotate the turbine and hence the generator connected to the central shaft and produce electrical energy.

Reactive Force Technique

When the wind blows over the disc most of the kinetic energy of the wind is used to create the drag force when it is imparted on the discs, but still it contains enough energy to flow past the discs. These discs are angled, due to which one side of the disc is higher than the other side. The wind flows past these discs from the side which is slightly lower than the other side. Here the wind speed is still slightly higher than the tip velocity of the rotating disc and hence while leaving the disc it imparts some reactive force on the tip of the disc in the direction of motion of the disc tip. This force contributes to the total torque generated at the center and this torque can be calculated as the force times the distance between connecting rod disc attachments to the center of the shaft.

Adaptable Disc Technoloygy

This is the technique which we have developed and it gives turbine the name adaptable bladeless disc wind turbine. An ideal turbine should provide almost constant power output in variable wind speeds and also offer a control over the turbine speed in case of emergency or high wind conditions. This control over the speed could be effectively achieved by changing the blade angle with respect to central shaft. When the wind flow is having a lower velocity the angle of all the blades could be increased due to which greater tangential forces would de-velop; when the wind speeds are very high, this angle will be reduced due to which lesser tangential force would be generated and hence the speed of the turbine could be maintained in the given range of wind speeds.
This change of the disc angle could be either made by a servo mechanism or by a mechanical means such as a torsion spring. Here we are initially using a tension spring which will make the entire system less bulky than a servo and a controller unit. The tension spring will be mounted between the connecting rod and the central hub inside the hub itself. Some initial tension would be maintained in the spring and when excess stress would develop due to high wind conditions the torsion spring would slightly twist thus twisting the connecting rod and eventually the disc angle and controlling the turbine speed in most of the variable wind conditions, acting like a mechanical governor system.

Proof of concept

In order to realize the concept in the form of workable model a small scale model of Bladeless Disc Turbine was built and along with this a model of traditional three bladed wind turbine of similar dimensions was tested.

Experiment

An experiment was designed to compare the electrical output power produced from a traditional and the advanced design. Two turbines having the similar centre to tip distance were constructed and were exposed to the wind draft generated by a horizontal fan, the distance between the fan and the turbine was fixed for both the turbines under test to 7 meters. The fan was set to constant speed to generate approximately same wind speed as experienced by both the turbines.

Outcome and Conclusion

Voltage Generated by each Turbine

The experiment carried out under similar wind conditions displayed the higher efficiency of Bladeless Disk Turbine over a Traditional Wind Turbine. Our design was capable of producing a peak voltage of 19.8 volt DC as against the traditional one producing peak of only 7.1 volt DC. The average voltage generated by our design was around 16 volts DC and that for the other was around 5.5 volts. Disc Turbine is capable to produce voltage more than twice that for a traditionally made turbine. The area swept by both the turbines is same indicating that same power could be generated by the advanced design with consuming only half the space as occupied by a regular one.

APPLICATIONS

Adaptable Bladeless Disc Wind Turbine is essentially a design for generating energy by harvesting the wind energy by consusuming minimum space and producing much higher power output and capability to work in low wind conditions. Due to this there is an immense scope in various fields which require energy to function.

The scaled version of such a turbine can be used for offshore wind-farm projects which work away from the coast and can generate adequate power to meet the demands of a small city.

It could be effectively used for off grid power requirements where such turbine could suffice the need of small power requirement.

These kinds of turbines are well suited for military outpost and cities of developing and developed countries as it occupies less space and does not produce noise when it is operating. Along with this the huge disc could even capture the lightest breeze which enables it to produce electrical power in low wind conditions in cities.

CONCLUSION

Wind turbines are today primarily used for the purpose of generating electrical power without depending upon the depleting sources of fossil fuel. Wind Power has tremendous environmental benefits over any fossil fuel burning power station, but due to the massive size of these structures, their noise pollution in the locality, requirement of immense free space, constant high windy conditions, difficulty in transport of each fragile blade over long distance and a large amount of capital requirement has restricted the wide scale applications of all traditional wind turbines.

This research of Adaptable Blade Less Disc Wind Turbines aims at curbing various issues which cause the hindrance to the implementation of these power generators. This design requires much less space and can even produce power in very low wind speed conditions.

The material used for their construction would comprise of glass fiber central skeleton covered with a synthetic polymer fiber similar to the construction of an umbrella with a sophisticated design. Due to this the material cost of the turbine is much reduced. This kind of design can be constructed in modular fashion which facilitates the ease of transportation over long distances. Utilizing such kind of design would allow us to increase the energy production from the renewable source and eventually lessen the dependence over fossil fuel.

Minor Project Exhibition

Every year the students from the Third Year of Mechanical Engineering exhibit their Minor projects during the end of the semester with enthusiasm on its highest level. These projects are based on the subject of Mechatronics. The exhibition gives the students an opportunity to work with the Mechatronic systems that they have learned in the subject.

Cosidering experiences from their previous year of exhibition, every student was determined to make a well planned and efficient project this year. Many outstanding projects on topics like Gesture Controlled car, Home Automation using IR-LDR sensors, CNC drawing machine, Smoke detectors with mobile service system and Hand Gesture control of computer using Arduino were exhibited this year. These projects were surely an inspiration for the juniors.

Mini Project Exhibition

The freshers in the Department, the students of the Second Year of Mechanical Engineering showcased their mini projects with a lot of excitement. Being in the Second Year, every student was excited to apply all the theoretical knowledge they learned into a handmade project.

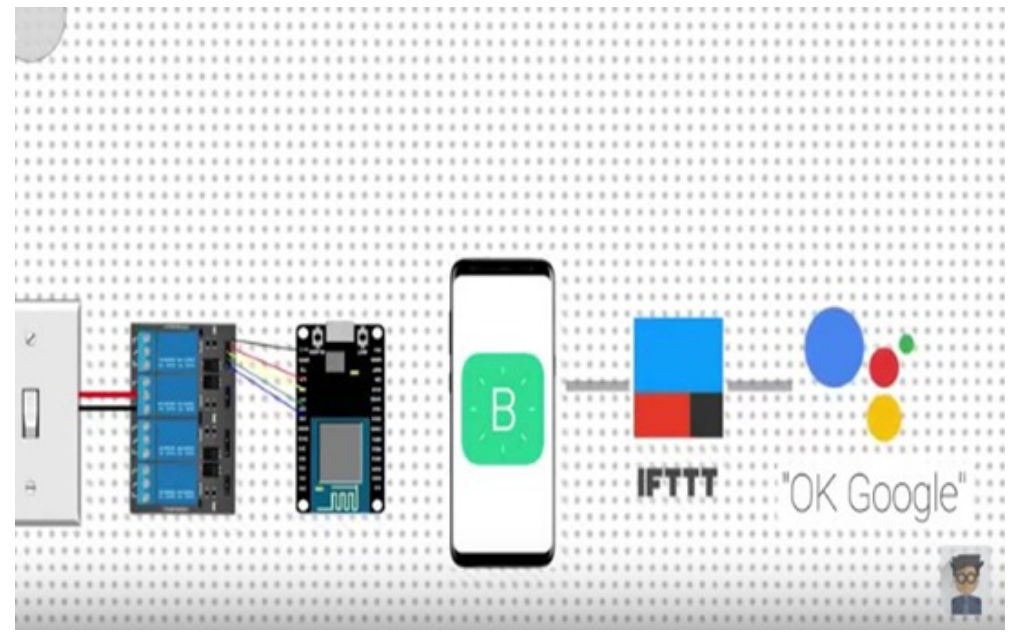
The projects were made on the subjects of Kinematics of Machinery and Fluid mechanics. Kinematics of machinery includes the use of basic mechanisms to perform various machinery operations or simply study the various parameters of a mechanism. Fluid mechanics includes projects based on the study of fluid flow and its effect on a body. Projects on topics like Gravity Light, Wind tunnel aerofoil, Newspaper Bag Folding Machine, Rocker Bogie Mechanism and Manometer Apparatus were displayed for the exhibition.

Home Automation using ESP8266

-By Abdul Moiz Ansari, Akbar Ali Agharia, Shubham Chauhan, Mandar Deshpande (TE MECH A)

INTRODUCTION:

The main objective of this project is to develop a home automation system using a Node MCU board with Internet, being remotely controlled by a smart phone. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house make it difficult for the user to go near them to operate. It becomes even more difficult for elderly or physically handicapped people to do so. Remote controlled home automation system provides a much more modern solution with smart phones.



Components:

- NodeMCU
- Relay
- Jumper
- USB wires

Software:

- Blynk Server
- IFTTT

ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability.

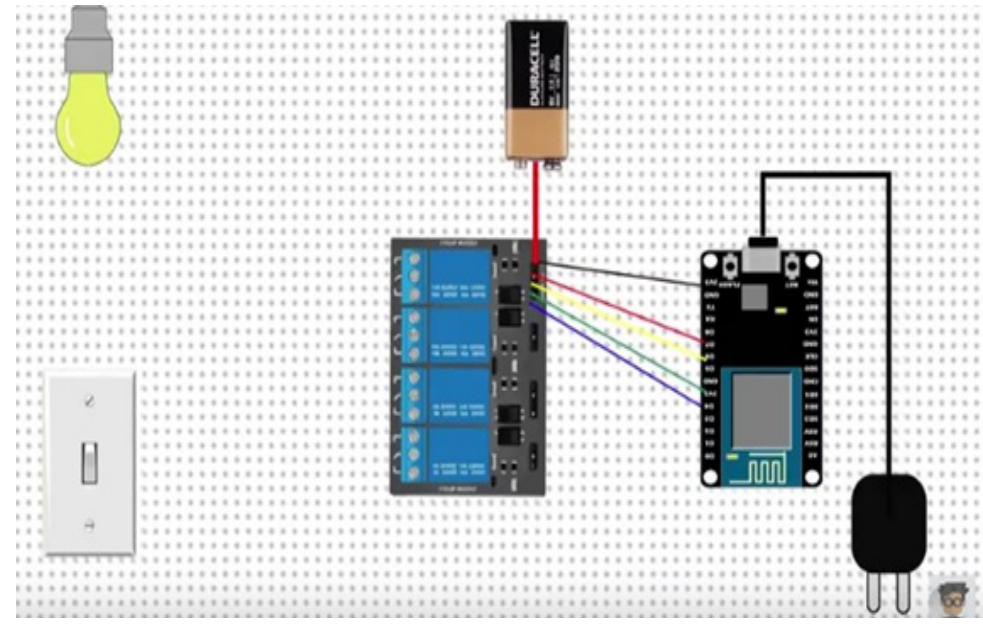
Working:

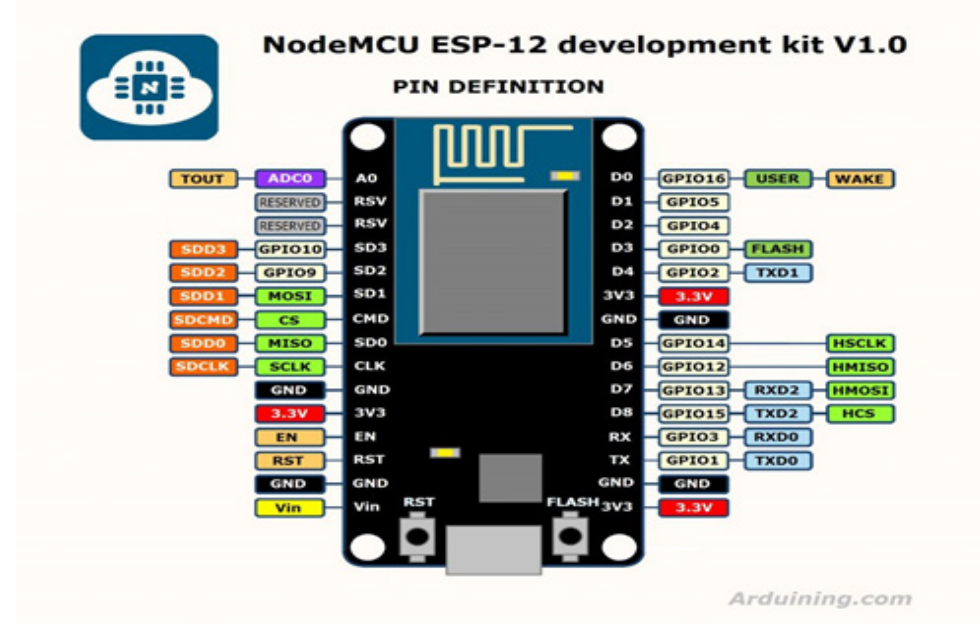
In order to achieve this, a relay module is interfaced to the Node MCU board at the receiver end while on the transmitter end, a GUI application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the GUI, the loads can be turned ON/OFF remotely through this technology. The loads are operated by IOT board through Relay Module.

Applications:

- This can be used in automation of home appliances such as bulbs, fans, TV, etc.
- This can be used at offices, hospitals and schools to reduce the human effort.
- This can also be used in industry for different system to give actuation signals to machines.

Circuit Diagram:





GESTURE CONTROLLED OBSTACLE AVOIDING CAR

-By Kshitij Nerurkar Kaustubh Patil Atharva Patke Tejinder Singh (TE MECH B)

INTRODUCTION:

We wish we could control everything with our own hands! Sitting in our chair and controlling things like a BOSS. We'd love it! So, we finally came out with a cool hand gesture recognition robot, which can follow the commands made by hand gestures. Making a gesture-controlled robot is actually very simple.

The robot is divided into two parts, transmitter and receiver. We have used an Arduino as the programming platform. To recognize the gestures made, we have used an accelerometer sensor.

Along with gesture control, we have clubbed in another feature, which is obstacle avoidance. The circuit has been fitted with an ultrasonic sensor, which senses any obstacle in its path and turns to a direction which is free from the same. The obstacle avoiding mechanism helps us to avoid any undesirable damage to the car and provide automation to the same.

METHODOLOGY:

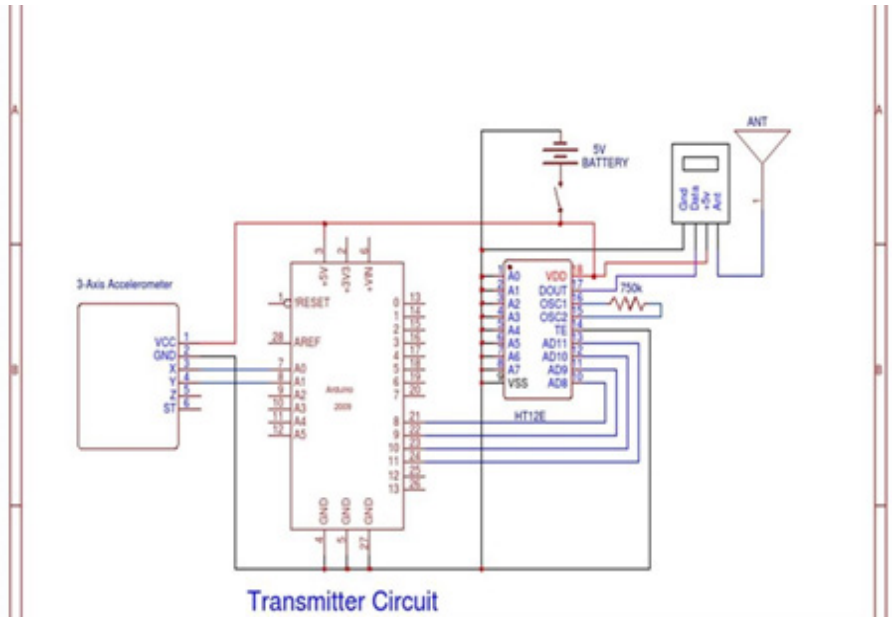
The project involves usage of two independent circuitry, one of gesture control and another of obstacle avoidance. The gesture control mechanism uses a hand glove fitted with an Arduino UNO, RF433 transmitter, HT12E IC and an accelerometer. Based on the movements recorded by the accelerometer, signals are encoded by HT12E, processed by Arduino and transmitted by RF433. Signals are received by the receiver placed on the car.

The receiver circuit includes HT12D decoder IC, L293D motor driver, IC7805 voltage regulator and RF433 receiver. Signals received from the hand gestures are decoded by HT12D and signals are sent to L293D driver. Based on the inputs received, the driver IC controls the wheels and moves them based on the inputs received from the hand gestures.
For the obstacle avoiding mechanism, L293D driver IC, Arduino Uno and SRO4 Ultrasonic Sensor is used. Ultrasonic sensor detects any obstacle in its way. If it encounters any obstacle, the car takes a turn and moves in the direction which is free from it.

DESIGN:

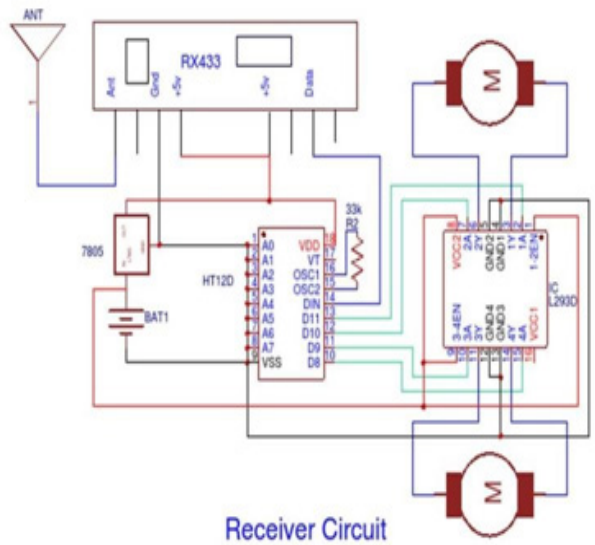
Obstacle avoiding mechanism is mounted on a breadboard and gesture-controlled mechanism is soldered on a prototyping board. The circuits for the same are as follows:

Gesture controlled mechanism - Transmitter



Transmitter Circuit

Gesture Controlled Mechanism-Receiver



Receiver Circuit

WORKING:

Gesture controlled mechanism:

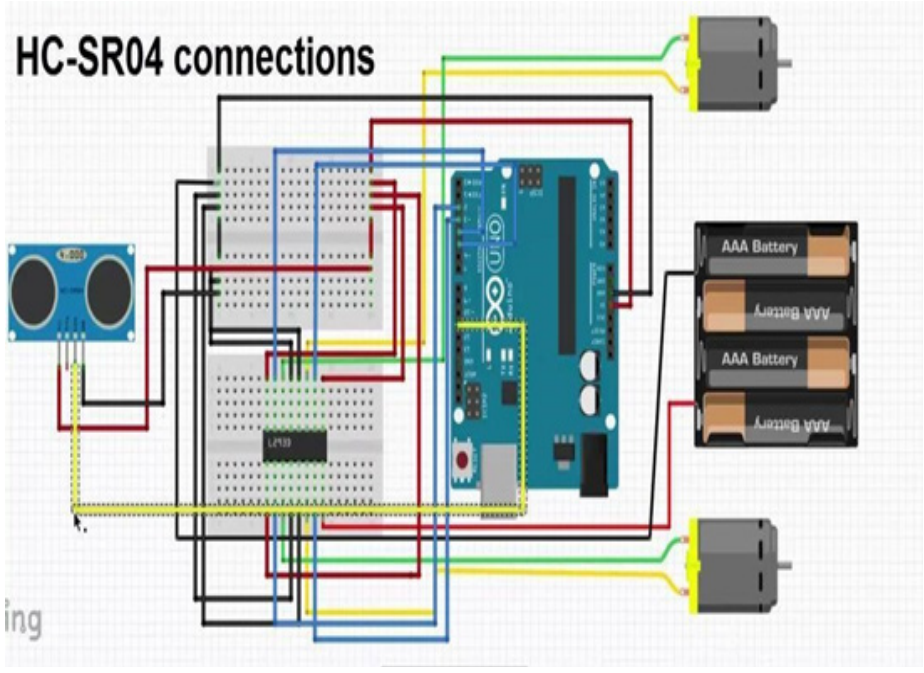
For the gesture-controlled mechanism, the circuitry consists of 2 parts, the transmitter and receiver. The transmitter consists of Arduino Uno, to which all other parts are attached. ADXL335 accelerometer records movements in X, Y, Z directions and sends them to Arduino Uno. Based on the way Arduino is programmed, it processes the received signal. The signals are then encoded by HT12E encoder IC and then transmitted wirelessly at 433MHZ by RF433 transmitter.

For the receiver circuit, signals are received from the transmitter, which are then decoded by HT12D IC. The decoded signals are then sent to L293D motor driver, which drives the four wheels according to received signals. Overloading and circuit damage is prevented by voltage regulator IC 7805. 9V batteries are used to power up the mechanism.

Obstacle avoiding mechanism:

L293D motor driver IC is responsible for running of all motors. The IC is connected to Arduino Uno, which controls output based on its programming. HC-SRO4 ultrasonic sensor senses any obstacles in the path and sends it to Arduino for processing. Based on these signals, the vehicle turns in the direction of no obstacle and moves in that direction.

Obstacle Avoiding Mechanism Circuit:



APPLICATIONS:

1. Gesture control completely removes the necessity of using a remote for control of a vehicle. Simple gestures can be used to control a vehicle.
2. In industries, for simpler use, goods can be manually transported easily using gestures.
3. In future, smart cars can be driven using this feature.
4. Obstacle avoiding mechanism can be used as a safety measure to avoid accidents and maintain integrity of vehicles.

DISADVANTAGES:

1. High voltage usage.
2. Complex construction.
3. Delicate and intricate design.
4. Complex methodologies to search for errors.
5. Skilled personnel needed for making the circuits.

FUTURE SCOPE:

Gesture control and obstacle avoiding mechanisms are the future of automation. In a few years, cars and carriers will be available with these mechanisms, which will make the foundation of smart cars. Human intervention in driving will slowly be made negligible and vehicles will be able to drive themselves on their own with the help of these mechanisms.

CONCLUSION:

The project is an ideal combination of two mechanisms- Gesture control and obstacle avoidance. The prototype will be able to work without the help of any remote control, and only on the basis of hand movements. Also, there will be no need of making safety mechanisms as vehicles will be able to do it on their own. These applications are able to depict the future possible developments in automation.

Gravity Light Aerofoil Testing

(Generation of electricity with Pulley arrangements.)

-by Nilay Gawde, Omkar Gaokar, Swapneel Dutt, Yash Bohra

Introduction

Electricity crisis is one of the biggest problems our world is facing. Many remote areas don't receive any Electricity, so they tend to use fire, kerosene lamps as an illumination source. These objects are hazardous and can cause many accidents. To tackle this a device that can produce electricity by the free falling of weights will solve many issues. This Technology is cheap, easy and has nearly zero maintenance cost.

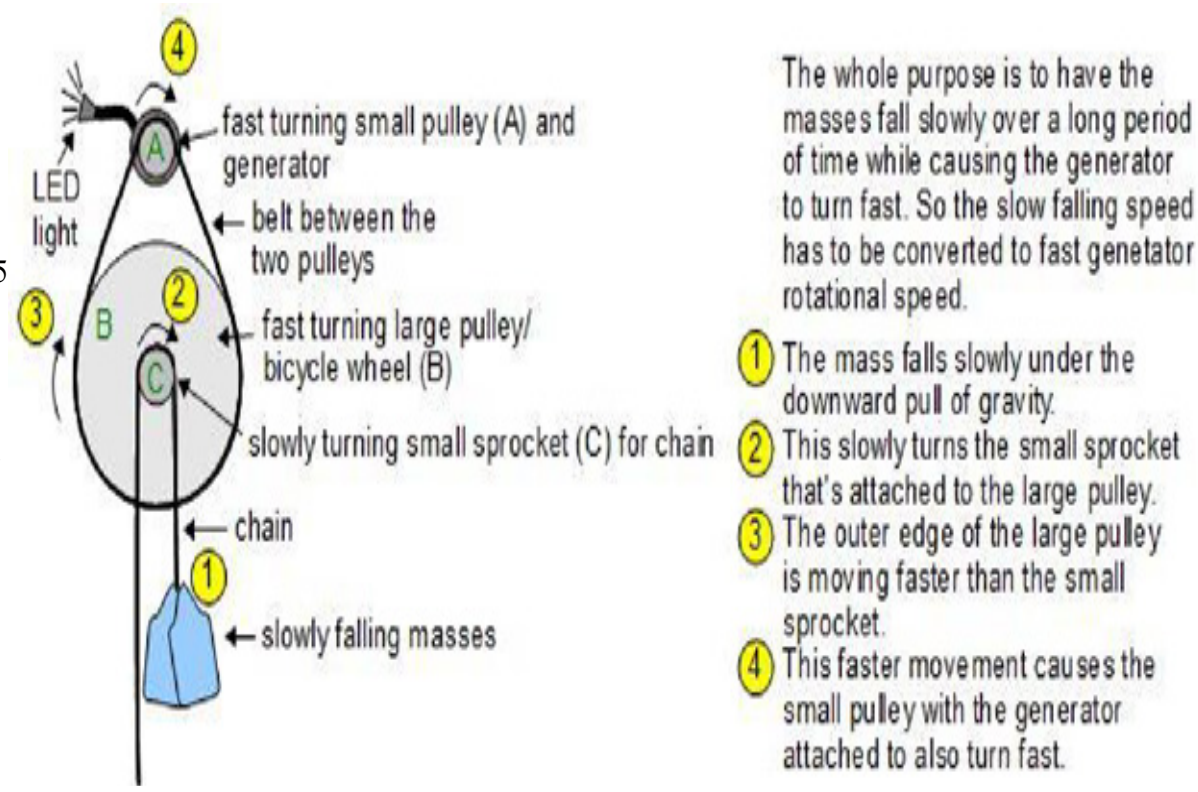
Methodology

The whole idea is to have the masses fall as slowly as possible, while still causing the generator to turn fast enough to power the LED light. Small sprocket that is turning slowly is attached to a fast turning larger pulley which is attached to a smaller pulley. The smaller pulley is attached to a synchronous motor which allows us to generate high power by turning the shaft slowly.

Design

Ar is the Linear Velocity of pulley A with a generator attached.
Br is the Linear Velocity of large pulley.
Cr is the Linear Velocity of small sprocket.

The generator shaft must turn 0.5mm each second. As motor is of 5 rpm.
For this, Ar=Br=10.5mm/s.
Cr comes out to be 0.73mm/s.
Hence the weights will fall slowly.
The pulley is driven by rope drive. The length of rope is calculated by
$L = \pi(R+r)+(R-r)2C+2C = 2121mm$.



Advantages

Low installation cost.
Safe to use.
Almost no maintenance cost.

Disadvantages

Electricity generation time is less.
Have to manually take the weights back to the top.
Electricity generated can run only low powered devices.

Application

To power light or fans in remote areas where Electricity is unavailable.

Conclusion

We can generate Electricity by the free falling of weights. Electricity will be generated continuously till the weights reach the lowest point.

Wind Tunnel Aerofoil Testing

-By Shivam Patil, Akash Pawar, Sanjay Purohit, Dipesh Sharma (SE Mech-B)

Introduction

A wind tunnel is a tool used in aerodynamic research to study the effects of air moving past solid objects. A wind tunnel consists of a tubular passage with the object under test mounted in the middle. Air is made to move past the object by a powerful fan system or other means. The test object, often called a wind tunnel model, is instrumented with suitable sensors to measure aerodynamic forces, pressure distribution, or other aerodynamic-related characteristics.

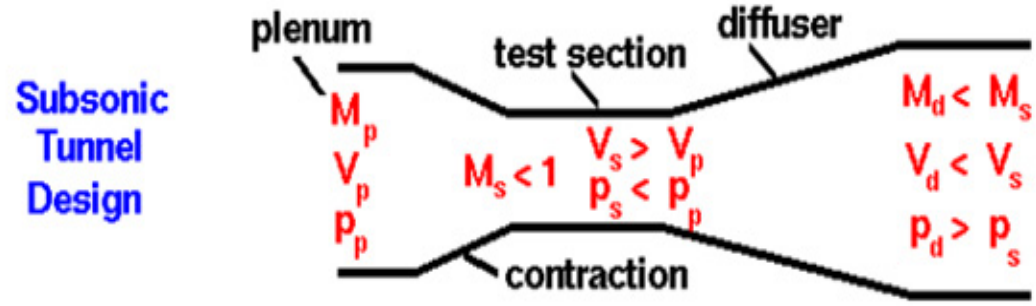
Wind tunnel testing of sporting equipment has also been prevalent over the years, including golf clubs, golf balls, Olympic bobsleds, Olympic Cyclists, and race car helmets. Helmet aerodynamics is particularly important in open cockpit race cars (Indycar , Formula One). Excessive lift forces on the helmet can cause considerable neck strain on the driver, and flow separation on the back side of the helmet can cause turbulent buffeting and thus blurred vision for the driver at high speeds.

DESIGN

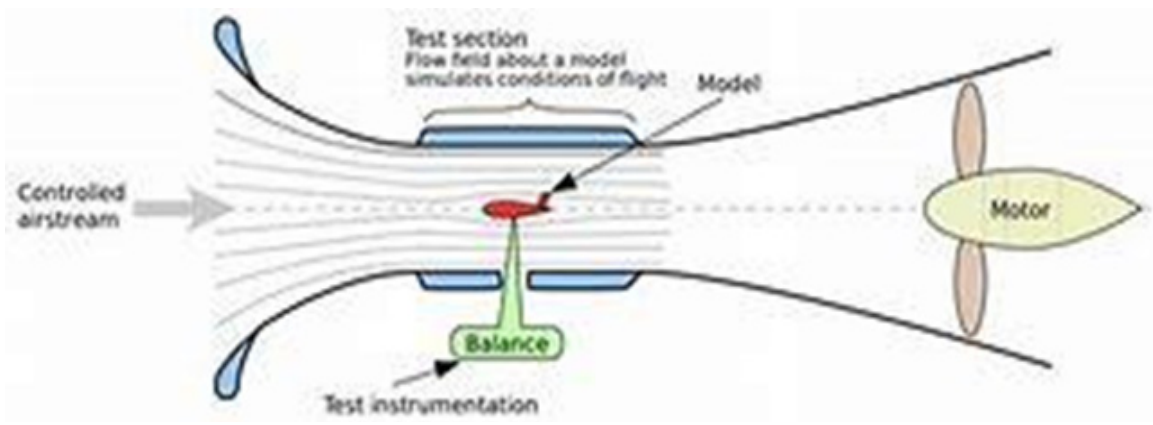
Wind tunnels are designed for a specific purpose and speed range and there is a wide variety of wind tunnel types and model instrumentation. The model to be tested in the wind tunnel is placed in the test section of the tunnel. The speed in the test section is determined by the design of the tunnel. The choice of speed range affects the design of the wind tunnel due to compressibility effects. For subsonic flows, the air density remains nearly constant and decreasing the cross-sectional area causes the flow to increase velocity and decrease pressure. Similarly, increasing the area causes the velocity to decrease and the pressure to increase. We want the highest possible velocity in the test section. For a subsonic wind tunnel, the test section is placed at the end of the contraction section and upstream of the diffuser. From a knowledge of the conservation of mass for subsonic flows, we can design the test section to produce a desired velocity or Mach number since the velocity is a function of the cross-sectional area. On the figure, we note the changes in Mach number, velocity and pressure through a subsonic wind tunnel design. The plenum is the settling chamber on a closed return tunnel, or the open room of an open return design.

WORKING

Air is blown or sucked through a duct equipped with a viewing port and instrumentation where models or geometrical shapes are mounted for study. Typically the air is moved through the tunnel using a series of fans. For very large wind tunnels several meters in diameter, a single large fan is not practical, and so instead an array of multiple fans are used in parallel to provide sufficient airflow. Due to the sheer volume and speed of air movement required, the fans may be powered by stationary turbofan engines rather than electric motors.



The airflow created by the fans that is entering the tunnel is itself highly turbulent due to the fan blade motion (when the fan is blowing air into the test section – when it is sucking air out of the test section downstream, the fan-blade turbulence is not a factor), and so is not directly useful for accurate measurements. The air moving through the tunnel needs to be relatively turbulence-free and laminar. To correct this problem, closely spaced vertical and horizontal air vanes are used to smooth out the turbulent airflow before reaching the subject of the testing.

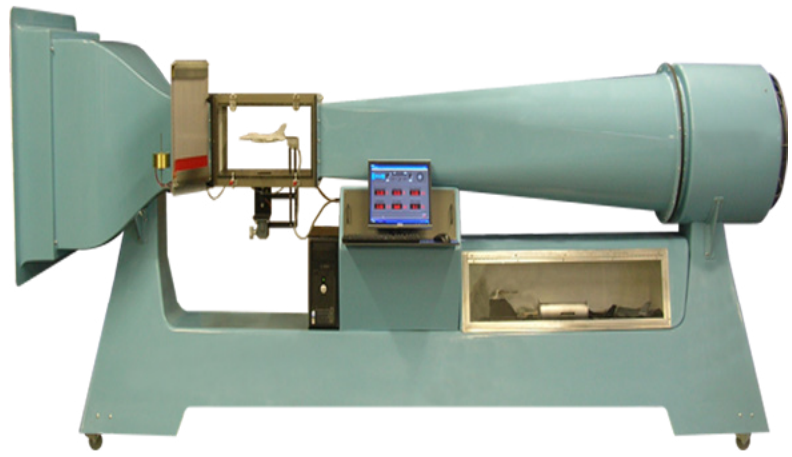


APPLICATIONS

Wind tunnels provide a concentrated stream of air in a vertical or horizontal flow. Quite often wind tunnels are used in the testing of products, such as seen in the automotive industry, to develop aerodynamic designs. Wind tunnels are also utilized for recreational applications such as indoor skydiving facilities. Howden American Fan Company is well known for the manufacture of wind tunnel axial fans. These tunnels are used in the studies of noise generated by flow and its suppression.

In wind engineering, wind tunnel tests are used to measure the velocity around, and forces or pressures upon structures. Very tall buildings, buildings with unusual or complicated shapes (such as a tall building with a parabolic or a hyperbolic shape), cable suspension bridges or cable stayed bridges are analyzed in specialized atmospheric boundary layer wind tunnels. These feature a long upwind section to accurately represent the wind speed and turbulence profile acting on the structure. Wind tunnel tests provide the necessary design pressure measurements in use of the dynamic analysis and control of tall buildings.

DISADVANTAGES



Wind tunnel testing is generally very expensive and time consuming. In addition, if the object to be tested (i.e. a car, an airplane) is too big to fit in the tunnel itself, a very accurate scale model must be produced, and Reynold's numbers (a number describing the flow conditions over the object) must be accurately matched to the expected operating conditions. These models can be prohibitively expensive as well.

A disadvantage would probably be that if it were to collapse, which i don't know if it could, then there almost wouldn't be a way to survive....or get to the surface of the water. Another disadvantage would be: if there was a hole in the channel tunnel then the whole tunnel would be flooded in seconds and that would be putting people's lives at risk! This person has absolutely no clue about the Channel Tunnel. A whole won't do ANYTHING to it, because it is not constructed in the water, but actually underneath the sea ground. Therefore this is not a valid disadvantage. A TRUE disadvantage to the Channel Tunnel is that it allows immigrants and asylum seekers to enter Britain illegally. Also it was extremely taxing on the economy as its costs 80% over its planned budget.

FUTURE SCOPE

Through the years the growth of Micro Aerial Vehicles (MAV) has gained increasing interest among engineers in the applications of military and civil domains. However obtaining accurate aerodynamic flying characteristics of MAV's was considered difficult due to their small size, the nature of their very low Reynold's number as well as the lack of testing methods. To overcome these complexities, the MAV's can be tested by using a subsonic open circuit micro scaled wind tunnel. This paper presents the development of wind tunnels analysed from research journals from the year 1937 to 2015 in order fabricate a micro scaled model of the tunnel to test the fundamental aerodynamics of a MAV flying at low speed and low Reynold's number. The study clearly indicates that micro scaled wind tunnels are certainly bringing infinite possibilities to studying and understanding the in-flight characteristics of very small aircrafts flying at the low speeds and having low aspect ratio.

CONCLUSION

By doing this project, we can see that divergence of air around any object. We can conclude that for different object different stream lines are generated along the surface of the object.

Industrial Visits

Vikram Sarabhai Space Centre

Vikram Sarabhai Space Centre:

Vikram Sarabhai Space Centre (VSSC) is the lead Centre of Indian Space Research Organisation (ISRO) under the Department of Space (DOS), Government of India. The Centre is named in fond memory of Dr. Vikram A. Sarabhai, the great visionary and the father of Indian Space Programme. VSSC pioneers in rocket research and launch vehicle projects of ISRO. The Centre also pursues research and development activities in associated areas like propellants, solid propulsion technology, aerodynamics, aero structural and aero thermal fields, avionics, mechanical engineering, aerospace mechanisms, vehicle integration and testing, etc.
VSSC is an entirely indigenous facility working on the development of the following:

Sounding rockets:

ISRO launches smaller rockets from the Rohini series on suborbital and atmospheric flights for aeronomy and meteorological studies. ATV, ISRO's heaviest sounding rocket, can be used for microgravity experiments and for precursor experiments to characterise new technologies.
Satellite Launch Vehicles- Satellite Launch Vehicle-3 (SLV-3) was India's first experimental satellite launch vehicle, which was an all solid, four stage vehicle weighing 17 tonnes with a height of 22m and capable of placing 40 kg class payloads in Low Earth Orbit (LEO).
Augmented Satellite Launch Vehicle-With a lift off weight of 40 tonnes, the 24 m tall ASLV was configured as a five stage, all-solid propellant vehicle, with a mission of orbiting 150 kg class satellites into 400 km circular orbits.

Polar Satellite Launch Vehicle:

PSLV is the third generation launch vehicle of India. It is the first Indian launch vehicle to be equipped with liquid stages. The vehicle successfully launched two spacecrafts – Chandrayaan-1 in 2008 and Mars Orbiter Spacecraft in 2013 – that later travelled to Moon and Mars respectively. Due to its unmatched reliability, PSLV has also been used to launch various satellites into Geosynchronous and Geostationary orbits, like satellites from the IRNSS constellation.

GSLV MK II:

Geosynchronous Satellite Launch Vehicle Mark II (GSLV MK II) is the largest launch vehicle developed by India, which is currently in operation. This fourth generation launch vehicle is a three-stage vehicle with four liquid strap-ons. The indigenously developed cryogenic Upper Stage (CUS), which is flight proven, forms the third stage of GSLV Mk II

GSLV MK III:

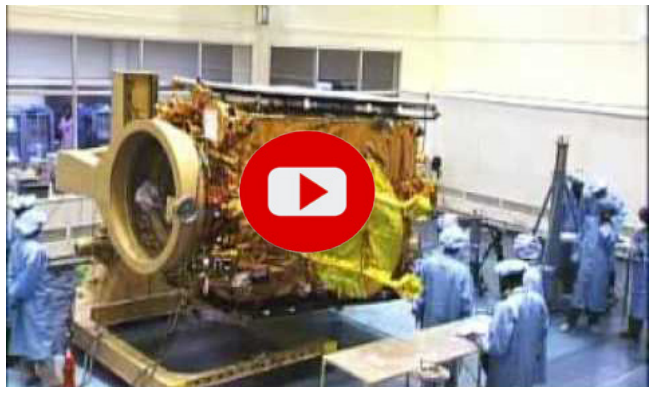
GSLV Mk III is a three-stage heavy lift launch vehicle developed by ISRO. The vehicle has two solid strap-ons, a core liquid booster and a cryogenic upper stage. GSLV Mk III is designed to carry four-ton class of satellites into Geosynchronous Transfer Orbit (GTO) or about 10 tons to Low Earth Orbit (LEO), which is about twice the capability of GSLV Mk II.

VIKRAM SARABHAI SPACE CENTRE

Vikram Sarabhai Space Centre

Location: Trivandrum, Kerala

R&D Projects:
Propellants
Solid propulsion technology,
Aerodynamics
Aero structural
Aero thermal fields
Avionics
Aerospace mechanisms,
Vehicle integration and testing



TERLS and the Space Physics Laboratory (SPL) are within the VSSC campus. SPL focuses on research activities in disciplines such as Atmospheric surface boundary layer physics, numerical atmospheric modelling, atmospheric aerosols, chemistry of radiation, atmospheric dynamics, etc.

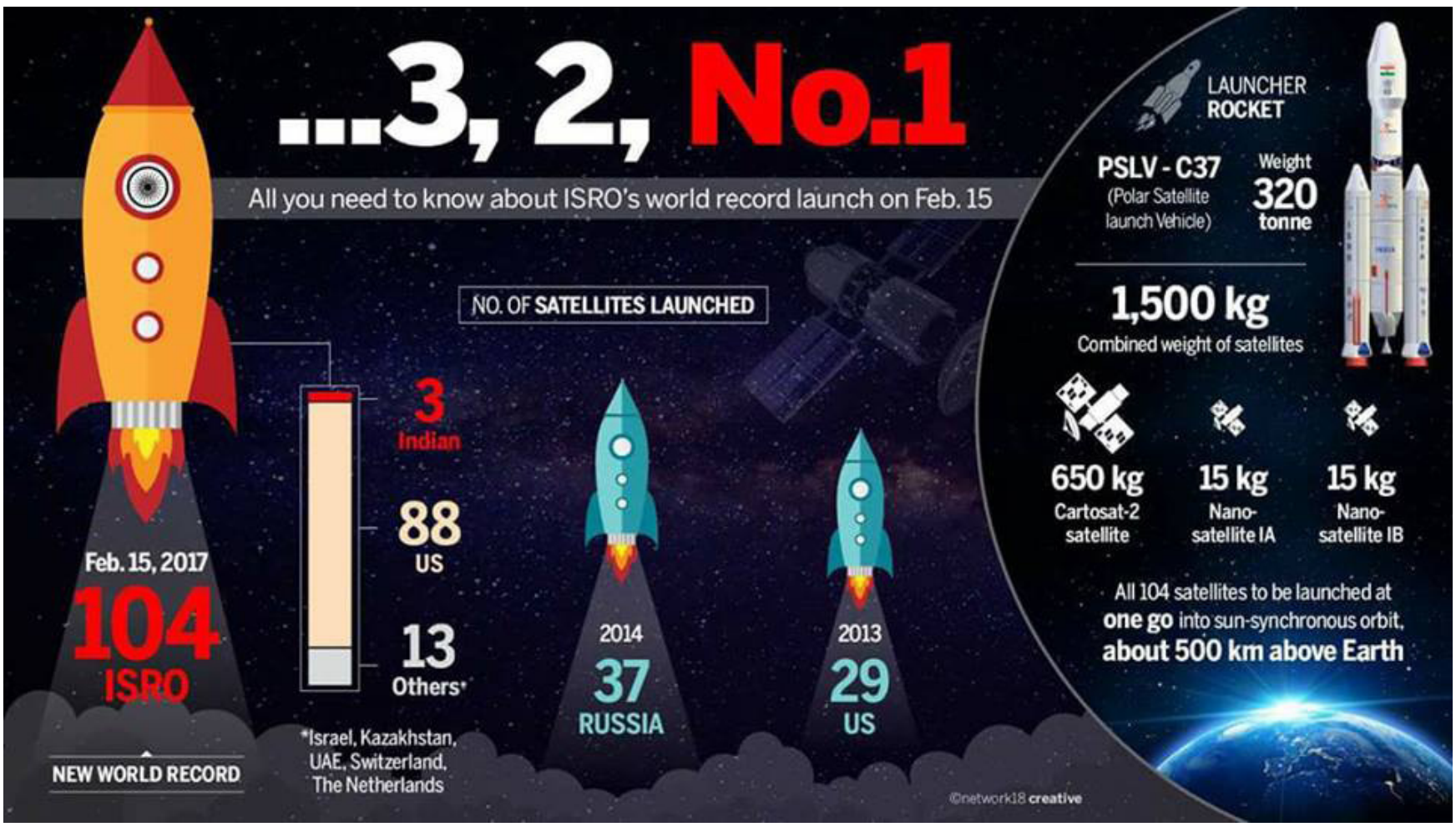
VSSC offers apprenticeship to graduates via Board of Apprenticeship Training (BOAT), Southern Region and Regional Directorate of Apprenticeship Training (RDAT), Southern Region having allotted training positions to the centre, under the Apprentices Act, 1961.

ISRO conducts its entrance exam every year to recruit engineers. Eligible students are called for an interview and if selected one can be lucky enough to bag the opportunity to get posted at VSSC.

Special Achievements of ISRO in 2017:

PSLV-C37 Successfully Launched 104 Satellites in a Single Flight.In its thirty ninth flight (PSLV-C37), ISRO's Polar Satellite Launch Vehicle successfully launched the 714 kg Cartosat-2 Series Satellite along with 103 co-passenger satellites on February 15, 2017. This was the thirty eighth consecutively successful mission of PSLV. The total weight of all the 104 satellites carried onboard PSLV-C37 was 1378 kg.

Geosynchronous Satellite Launch Vehicle



Kanan Devan Hills Plantations Company

Carrying forward a lineage that dates back over 136 years to the British Colonial Raj era, the Kanan Devan Hills Plantations Company Private Limited (KDHP) succeeded Tata Tea Limited, when the latter exited most of its plantations in Munnar to focus on the growth of its branded tea business.

The **Kanan Devan Hills Plantations Company** was formed, making it the largest employee-owned tea company in the world. Encompassing the Participatory Management System of operations, where the shareholders of the company are mainly its employees.

Coming to the product, here's how the superior quality tea is made. First, the tea leaves are first plucked from the tea shrubs by hand. Then they are weathered to reduce the moisture content. These weathered tea leaves are then passed through a series of cutting machines where the tea leaves are cut into finer pieces through each pass. These finely cut leaves are then oxidized in fresh air in a rotating drum, and dried in hot air, to give them a typical tea like colour and aroma. At this time, twigs and other unwanted particles are present along with tea leaves. These unwanted particles are separated using filtration process. The tea is ready to leave its amazing flavour in the delicious beverage.

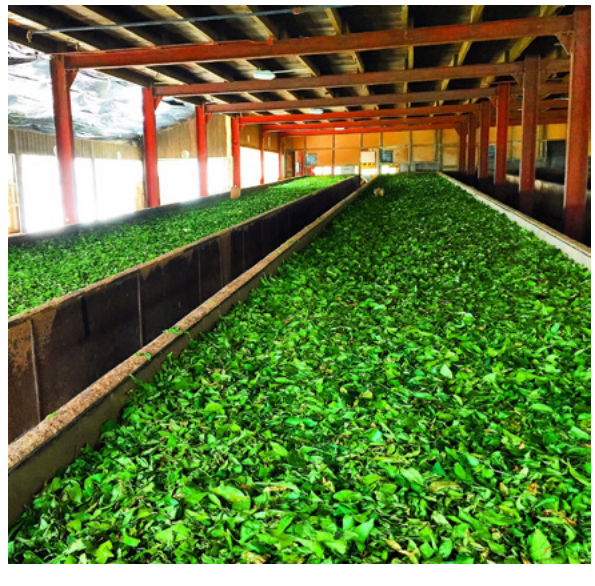
Kanan Devan Hills
Plantations Company (P) Limited

Kanan Devan Hills Plantations Company

Location: Munnar

Plantation Area : 24000 Hectares

Products:
Green Tea
Organic Tea
Orthodox Tea



Tolin's Rubber Tyres Pvt. Ltd.

Founded in 1982 Tolins Tyres has initiated in this arena as an SSI unit, the Group has established itself as a major tyre retreading solutions provider across India. Quality, durability, technology, value and international standards coverage at Tolin's manufacturing plants in India and abroad.

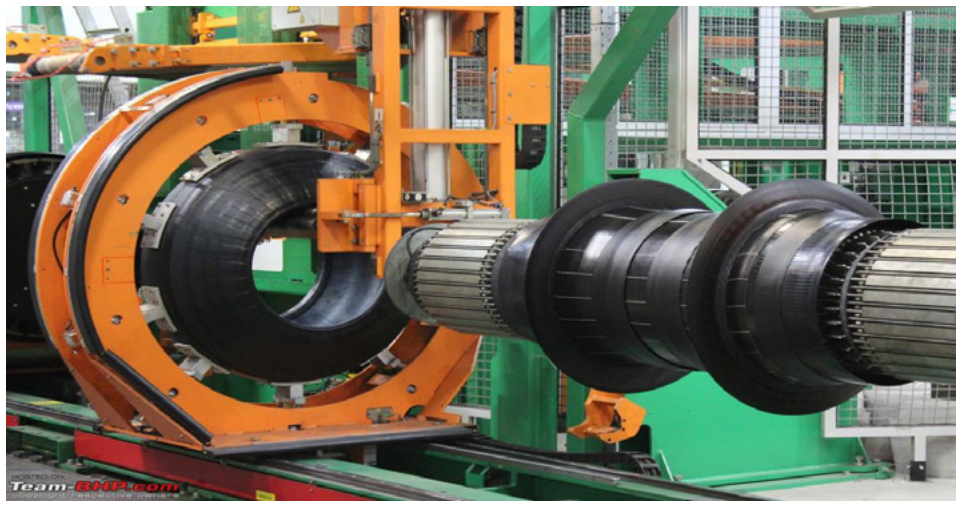
The factory starts the manufacturing process by mixing the raw materials to form the rubber compound. Gigantic mixers, hanging like vertical cement mixers, stir the rubber and chemicals together in batches. Each mix is then re-milled with additional heating to soften the batch and mix the chemicals. In a third step, the batch goes through a mixer again, where additional chemicals are added to form what is known as the final mix.

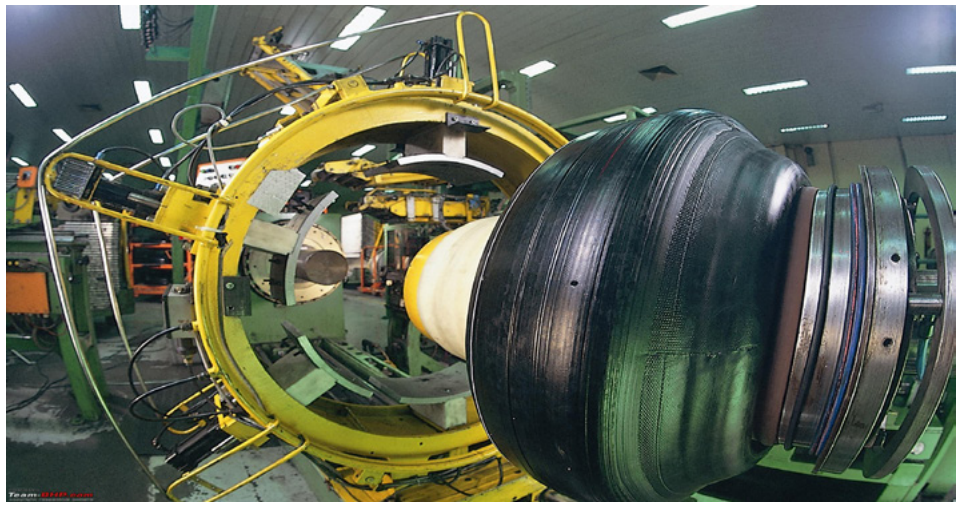
Once a batch of rubber has been mixed, it goes through powerful rolling mills that squeeze the batch into thick sheets. These sheets are then used to make the specific parts of the tire. For the beads of a tire, wire bundles are formed on a wire wrapping machine. In the extruder, the batch is further mixed and heated and is then forced out through a die a shaped orifice to form a layer of rubber. The extruded rubber layers for the sidewalls and tread are glued into place, and the assembled tire is removed from the tire-building machine. The tyre is placed inside a large mold for the curing process. During this curing process, the steam heats up the tire. After curing is complete, the tire is removed from the mould for cooling and then testing. The tyres are now ready to roll on the roads.

Tolin's Rubber Tyres Pvt. Ltd.

Location: Cochin
Established: 1982

Products:
LCV Tyres
Agricultue Tyres
Precured Tread Rubber





Local Industrial Visit to Vaitarna Hydro Power Plant

The official Industrial Visit to Vaitarna Hydro Power Plant was organized by the Mechanical Department on 28, March 2018.Hydro energy is available in many forms like potential energy from high heads of water retained in dams, kinetic energy from current flow in rivers and tidal barrages, and kinetic energy from the movement of waves on relatively static water masses. Many ingenious ways have been developed for harnessing this energy but most involve directing the water flow through a turbine to generate electricity and Vaitarna power plant is an underground power plant which works on the same principle.

It can be accessed via a tunnel which is an engineering marvel in itself .The plant has a power generation capacity of 60 MW and produces power for about 6 months in a year from January to June during which it runs round the clock. From July to September the used water is pumped backed to the reservoir and from October to December the plant goes under maintenance. The maintenance is aided by an overhanging crane which is used to move heavy components to the maintenance station. The power generated is transferred to the Igatpuri power station to be sent to the Western Electricity Grid.

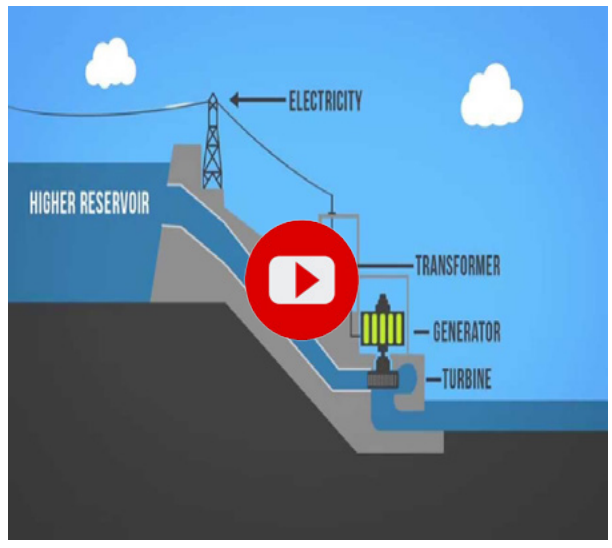
The turbine used was a Francis Reaction Turbine. In a Francis Turbine water flows radially into the turbine and exits the Turbine axially. Water pressure decreases as it passes through the turbine imparting reaction on the turbine blades making the turbine rotate. Francis Turbine has a circular plate fixed to the rotating shaft perpendicular to its surface and passing through its center. This circular plate has curved channels on it; the plate with channels is collectively called as runner. The runner is encircled by a ring of stationary channels called as guide vanes. Guide vanes are housed in a spiral casing called as volute. The exit of the Francis turbine is at the center of the runner plate. There is a draft tube attached to the central exit of the runner.The design parameters such as, radius of the runner, curvature of channel, angle of vanes and the size of the turbine as whole depend on the available head and type of application altogether.

The water of the Vaitarna River is collected in the reservoir on the upper part (head rise) of the dam. The head rise is connected to the tail rise (lower part) with the help of a penstock .The length of the penstock is about 700mThe vertical distance from the head rise to the tail rise is 200m. This means the turbine receives a water head of 200m. This high head (pressure/potential energy) of the turbine is converted into mechanical (rotary) energy of the turbine shaft which is connected to the generator where the rotary motion is converted into single phase electricity with a voltage of 11 kV.Other equipments included spherical and bypass valves,

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.

Vaitarna Hydro Power Plant

Location: Vaitarna
Established: 1957
Area: 8.39 sq.km
Power Generation
Capacity : 60 MW
Power Generation
Duration: January to June



The exciter:

The generator while producing electricity also has to produce this at a constant voltage for the electrical system to work properly. Controlling the magnetic field controls the voltage output of the generator and Static exciters offer a better control of the output than an electromechanical control.

The transformers:

The plant has three small transformers instead of a bid one due to the size constraints of the tunnel. Transformers are used to increase or decrease the alternating voltages in electric power applications. The plant uses three step up transformers which increase the voltage from 11kv to 132 kV .This high voltage is sent to the nearest Igatpuri power station for distribution to the entire state.

Cooling and lubrication systems.

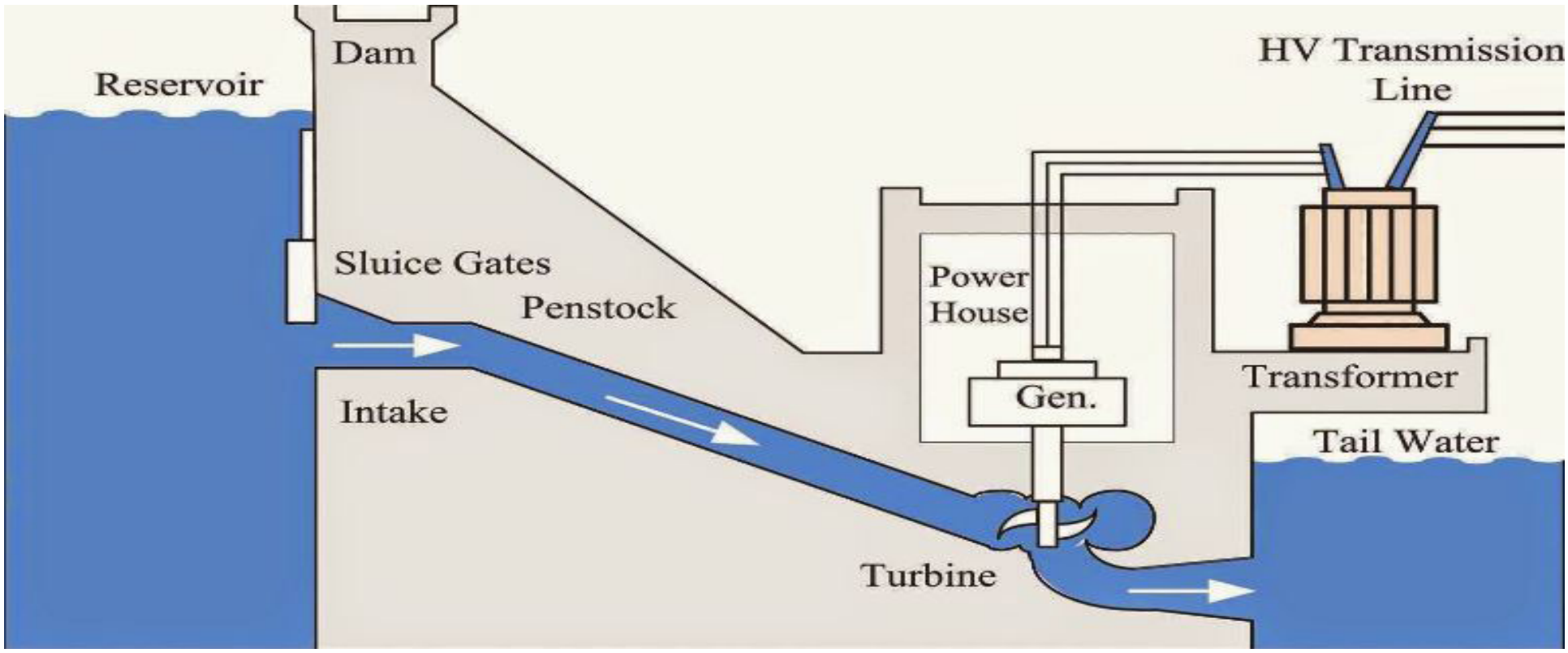
For a typical power plant Turbine-Generator unit, lubrication motors consists of the following:

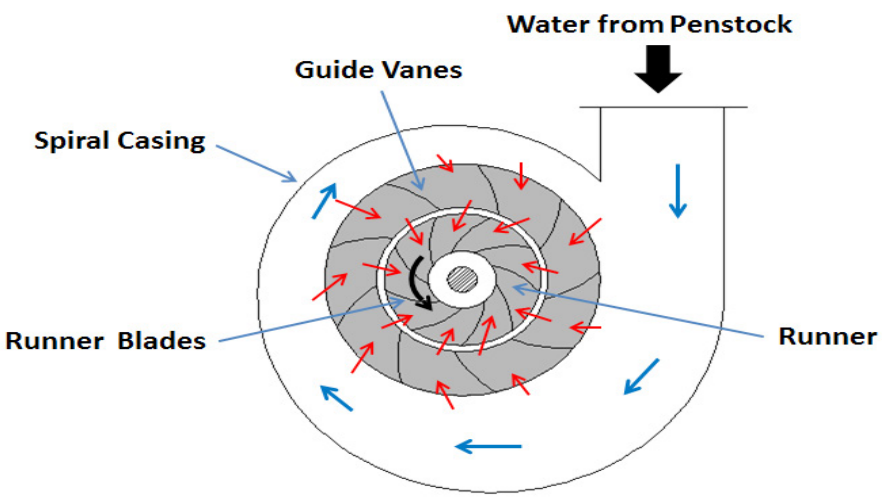
Shaft-driven main bearing oil pump (MBOP)

AC motor-driven turbine bearing oil pump (TBOP)

DC emergency bearing oil pump (EBOP)

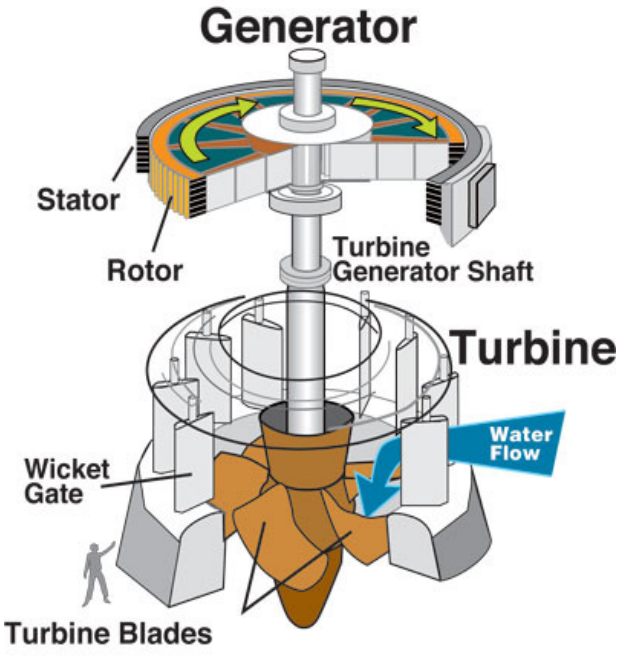
These components have to work flawlessly together and perform their own tasks precisely so that we get uninterrupted electricity; all this is achieved only by exceptional engineering and the diligence of the people working there. Any pursuant of engineering can garner a lot of knowledge by observing such engineering marvels and then in their own way can improve this field by innovation and optimization.





Reaction Turbine

Francis Reaction Turbine



Local Industrial Visit to Die Casting Industry

The Mechanical Department of Thakur College of Engineering & Technology organized a Local Industrial Visit to Veena Die Casters & Engineering Pvt. Ltd., Thane West, in collaboration with Consideration of Indian Industry (CII) for the second year students. The main objective of this trip was to give the students on hand practical experience of the industry and its working.

The Veena Diecasters & Engineers Pvt. Ltd. is one of the four units of a well-known ISO 9001:2015 certified company SIPRA Engineers Pvt. Ltd. that has a well-known reputation in the casting industry with several Indian as well as Japanese countries as its clients in the pipeline. They started manufacturing Aluminium Alloy Pressure Die Castings in 1974 with Body Reed Valves (BRVs), Cover Reed Valves (CRVs), and Float Chamber Valves (FCVs) being their major products and on growing order of six lakh parts per month. The plant covers an area of approximately 1247 sq.mt. along the annual turnover being approx. ₹120 Cr. Along with casting they also have arrangements for other processes necessary for producing efficient products such as Fettling Set-up, Shot Blasting Set-up, Vibro Set-up, Trimming Machines, Leak testing, etc. The students were briefed about the die making process at start followed by the High Pressure Die Casting (HPDC) process. Here the molten Aluminium alloy (at a temperature of 700 oC) is poured in the casting moulds. The company is currently using machines – HMT Make 180T and HMT Make 120T i.e., with capacity of 120 and 180 metric ton respectively. On application of high pressure the casting was formed.

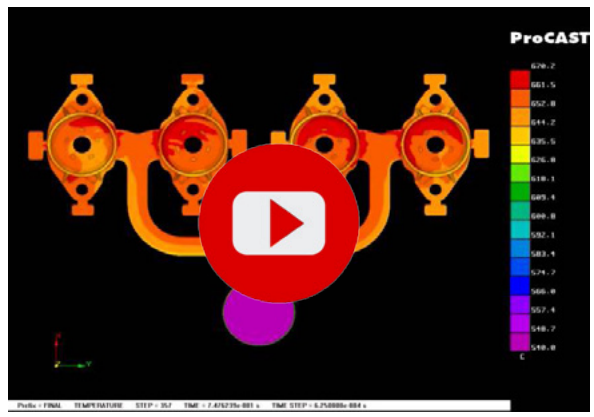
In simple words this process is somewhat similar to Injection Moulding instead they didn't use any injecting procedure. The next step after shot (cast) formation is desisting undesired parts such as risers, runners, sprue by using trimming machines i.e., passing it through the Fettling Set-up. Then the products are forwarded to the Shot Blasting Set-up where the products were heated and later cooled to improve the durability of the product. Then the products are redirected to the Vibro station – where the shots are collectively placed in a vibrating tumbler along with ceramic stones for 1 or 2 hours. This ensures the elimination of any extra burr and provides shiny lustre to them. Now the final step of the entire manufacturing process is the Inspection process. Here besides finishing of the product, the leaks, cracks, or any other deformity is looked upon with a Decay Leak Tester. The advantage of air decay testing is its relatively quick decay cycle with feasible leak allowance of around 30%. The HPDC process is effective as it gives minute accuracy and surface finish greater than 1.6 microns

SIPRA
Quality diecastings

Veena Die Casters & Engineering Pvt. Ltd.

Location: Thane (West)
Established: 1974
Area: 1274 sq.mt

Products:
Body Reed Valves (BRVs) Cover Reed Valves (CRVs) Float Chamber Valves (FCVs)



Throughout the trip it was observed that the main part of the procedure was labour intensive. For example the entire Fettling process was carried out by several labours doing most of the machining processes by their hands. This increased the chances of errors and thus currently requires more levels of quality inspection. Further this can be improved by introduction of automated machinery for fettling and other processes, thus reducing human error and improve the yield intensively as well as extensively.

ACHIEVEMENTS

Batch 2017-Top Scorers

GRE Top Scorers

Name of student	Score/340
SHETTIGAR SANJANA SUHAS SANDHYARANI	328
PAWAR AKASH PRAKASH ANITA	315
PILLAI AISHWARYA SATEESH REMA	315
MISHRA MALVIKA MANIKANT MAMTA	314
SAVLA KEVAL RAJESH RASILA	313
PATIL SAHIL PRATAP VARSHA	312

TOEFL Top Scorers

Name of student	Score/120
PILLAI AISHWARYA SATEESH REMA	117
MISHRA MALVIKA MANIKANT MAMTA	116
SHETTIGAR SANJANA SUHAS SANDHYARANI	115
DOGRA JITENDRA PANSINGH MOHINI	107
PATEL KRISHNA VIKASBHAI SHEELA	104
SAVLA KEVAL RAJESH RASILA	100

CAT/CET Top Scorers

Name of student	Exam	Score(Percen-tile)
JANGAM CHINMAY	CET	99.29
AGARWAL TARUN BHARAT RITA	CET	94.00
AGARWAL TARUN BHARAT RITA	CAT	92.00
KOTHARI NISARG PARESH CHETNA	CET	91.00
RAIKAR SHUBHAM	CAT	91.00

Gate Qualified Students

Name of student	Score/100
SINGH AKASH PRADEEP	56.11
GUPTA SAGAR POONAMCHNAD	52.37
BHANDARI PRATIK HEMANT	51.32
KADAM SAMRUDDHI	39.10
TIWARI VIPINKUMAR	37.70
GEDIA BHAVIK KANUBHAI	34.26
UPADHYAY ESHAN	34.00
GAJERA JAYDEEP PRAVINBHAI	33.92

RASHMI SHEREGAR

"Rashmi has been selected for the Indian team for 2020 Olympics."

The Mechanical Department of TCET is a chest full of valuable treasure stored in there, out of which one gem shines a little brighter. Rashmi Sheregar, currently in the Second Year has achieved a lot in a very short time and has made the Institution very proud. She has represented India in the Common Wealth Youth Games, 2015. Rashmi is also a Junior National Record Holder in 100m with an impressive timing of 11.89 seconds. Not only this, she is also a Senior National Games (India Olympics) Record holder and medallist clocking 11.70s seconds. She has bagged twenty national medals and has also been awarded the best athlete award four times. The list does not end here, there's more.

Achievements

- **Represented India in Commonwealth Youth Games 2015 in the event 100m and gained the fifth position in the finals.**
- **In 2017, fastest Women of Mumbai University running a Meet Record representing TCET. Consequently, qualified for All India university and Ashwamedh Maharashtra university Meet.**
- **Won a gold and a silver in Ashwamedh Maharashtra university Meet in 100m and 4*100m.**
- **Achieved the fifth overall rank in All India University Meet, Guntur in 2017.**

"Kudos to Rashmi and all the best to her in all her future endeavors."

PRATIKSHA DAS

Pratiksha Das from the Third Year of Mechanical Engineering has immense love for bikes. She is the fastest female racer in Mumbai for the Aamby Valley Drag Race, 2017.

Pratiksha has led the Shivsena Gudi Padwa rally on a beautiful 1200 CC Harley-Davidson. She got featured in 10 newspapers across India for the act. She also led the Safety rally at Hinduja College, which was flagged off by the transport minister of Mumbai.

Pratiksha successfully arranged and pulled off the Superbike Show for our college in Zephyr, 2017. The show was a blast and was one of the highlights of the festival after it went viral all over Mumbai.

At this very young age, Pratiksha is also invited as chief guests in other colleges like Hinduja college, Wilson college, Patkar college and Sardar Patel college for various events. She is doing a great job with her talent and love for bikes.

The Student Editorial Committee

From Left to Right:

Vishal Tiwari, Ruchi Pourana, Shivani Velapure, Abhishek Upadhyay, Mir Shabahat Aftab

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Mr. Pawan Tiwari

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Shivani Velapure
Mir Shabahat Aftab

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