KMCT
POLYTECHNIC COLLEGE, KUTTIPPURAM

MECHAZINE

DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL MAGAZINE VOLUME 3. "2022"

ABOUT THE COLLEGE

KMCT Polytechnic College, Kuttippuram was established in 2014 with a key determination to provide quality technical education for socially and economically backward classes at this area. The college is rising progressively as one of the top notch Polytechnic Colleges in Kerala.

Approved by AICTE and affiliated to Directorate of Technical Education, Govt. of Kerala, KMCT Polytechnic College encourages and gives better technical education for students to excel in the highly volatile marketplace.
A vast number of students from different parts of the state are trained within the portals of our institution. The college is situated at Pazhoor, in Kuttippuram, Kerala.

VISION OF THE COLLEGE

Be a premier technical institution of academic excellence by imparting value based professional education with social responsibility.

MISSION OF THE COLLEGE

- *To produce self-motivated, skilled professionals of academic excellence.*
- *To provide value oriented quality technical education through innovative teaching learning process.*
- *To equip students to be Responsible Professionals for the betterment of society.*

ABOUT THE DEPARTMENT

Mechanical engineering is the branch of engineering that involves the production and usage of mechanical power for the design, production, and operation of machines and tools. K.M.C.T. Polytechnic College's Mechanical department aims at the development of technology with research initiatives at its spine. The goal of the curriculum is to create flexible educational experience in mechanical design, management and emerging science.

The principal study topics include fluid mechanics, thermodynamics and heat transfer, manufacturing process, metallurgy and machine tools, production drawing, machine drawing, material science & engineering, machine design, industrial engineering, CAD, CAM, etc Mechanical Engineering relating with Aerospace Engineering, Metallurgical Engineering, Civil Engineering, Electrical Engineering, Petroleum Engineering, Manufacturing Engineering, Chemical Engineering, and other Engineering Disciplines.

VISION OF THE DEPARTMENT

To achieve excellence in mechanical engineering by imparting technical and professional skills to meet industrial and social needs.

MISSION OF THE DEPARTMENT

1. *To impart sound foundations in Mechanical Engineering and its related fields to excel in academics and career.*
2. *To develop students as competent professionals with strong emphasis on social and ethical values.*
3. *To cultivate technical and creative skills for creating young professionals to meet industrial and social challenges.*

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Program Educational Objectives (PEOs) are broad Statements that describe what Graduates are expected to attain within a few years of Graduation. Program Educational Objectives are based on the needs of the program's Constituencies.

OBJECTIVES OF THE PROGRAMME

PEO1: Shall excel in Industry, in higher studies, research and as entrepreneurs.

PEO2: Shall acquire continuous technical knowledge in Mechanical and allied engineering leading towards innovation and creativity.

PEO3: Shall have good communication skills, interpersonal skills, managerial skills, leadership skills, ethical values and understand the need for lifelong learning.

PROGRAMME OUTCOMES (PO's)

PO1: **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO2: **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.

PO3: **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO6: **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes

PROGRAMME SPECIFIC OUTCOMES (PSO's)

PSO1: Apply the principles of mechanical engineering to design and develop innovative products useful for the safe and sustainable development of industry and society without deviating the quality of the environment.

PSO2: Apply the knowledge and principles of engineering by emphasizing human values to excel in career and entrepreneurship

MESSAGE FROM PRINCIPAL

I am proud to announce the release of ‘MECHAZINE’ magazine’s first issue. The magazine signifies the writer’s penmanship and also allows them to share their ideas . I am happy to meet all of you through this Technical Magazine and I thank all the staff who strived to give professional education in a new perspective and achieve perfection in all the fields.

The main reason for our tremendous performance in various activities is the involvement of the faculty members who motivated students whole heartedly to participate in the seminars, industrial visit, inter activity session and other extracurricular activities to inculcate in them sound moral&strong value.

Mr. P H SUBAIR

Message by Head of Department

I am pleased to know that our students are successful in bringing their technical magazine MECHAZINE for this academic year 2021-2022. MECHAZINE, 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.

The greatest asset of the department is its highly motivated faculty. The available diversity of expertise of the faculty with the support of the other staff moulds the students to work in global multicultural environment without losing their ethical values.

We have hoped that we will continue to deliver our best to serve the society and mankind. It is also expected and that our students will continue to pass on the skills which they have developed during their academics at this department to the whole world for a better society. We will be happy to receive your suggestions for further improvement and development of our department.

Mr. VINEETH C.

Message by Students Counselor

It is a great pleasure and I feel honoured to be a part of this technical magazine of Department of Mechanical Engineering. This is one of the eminent departments of KMCT Polytechnic College Kuttippuram. Its first batch passed out in 2017. Students have shown tremendous potential not only in academics but also in co-curricular and extra curricular activities.

Foroverallpersonalitydevelopmentapartfromacademic, co curricular is the need of the hour. Students are encouraged to participate in inter poly competition. All these activities help them to get placed in reputed companies. They are also admitted in institution of high repute for higher studies outside kerala and abroad.

I congratulate all faculties, students and staff for their hard work in publishing technical magazine that will represent the insight of Mechanical Department.

Wishing them best of luck!

Miss. SREELAKSHMI KP.

MESSAGE FROM THE EDITOR'S DESK

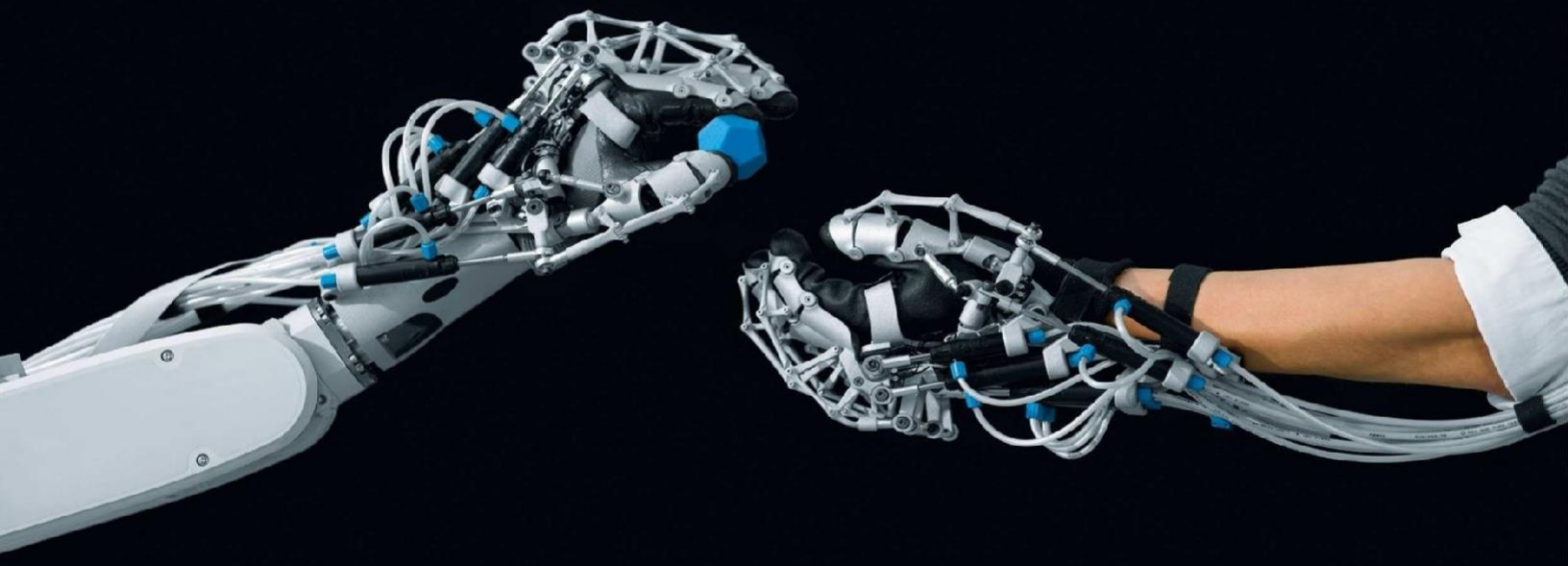
It gives me immense pleasure to present the issue of "MECHAZIN" magazine of the Department of Mechanical Engineering. It is the talent and outcome of our students which is reflected through this. This is one of the best platforms for our students to present multifaceted personalities and innovative ideas.

The objective of the magazine is to mainly focus on Achievement of the students from the Mechanical Department in the Co-curricular and Extra-Curricular Activities.

I congratulate all my team members for their constant effort in launching this Magazine. We are also thankful to our Management and Principal for their support and encouragement. Finally we are gratified to our reviewers for their frank opinions and constructive suggestions, for our colleagues and students.

Mr. HARIKRISHNAN R.

Faculty Articles



Waste Heat Recovery from Domestic Refrigerator

by Mr. VINEETH C

I. INTRODUCTION:

Waste heat is heat that is produced during a process through the burning of fuel or a chemical reaction, evacuated from the thermal system by a heat exchanger, and then "dumped" into the environment despite the fact that it may still be used for a beneficial and cost-effective purpose. Heat's "value," as opposed to its "quantity," is its most important characteristic. The method used to recover this heat depends in part on the cost factors and the temperature of the waste heat gases.

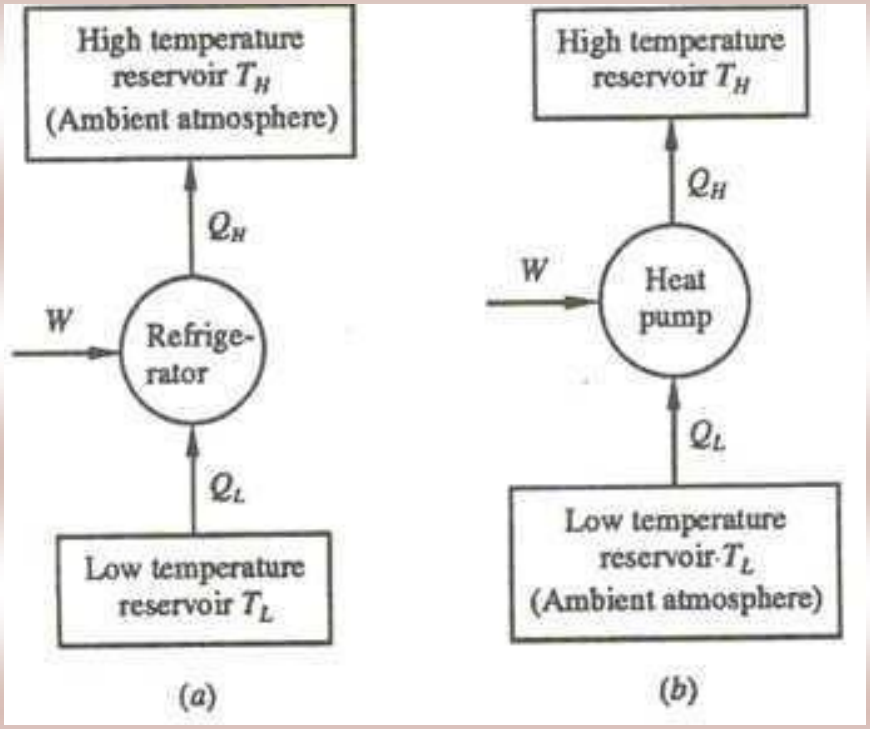
Use of waste heat recovery is an important technique of reducing total energy costs in energy system design. Attachments need to be developed to recover waste heat energy from air conditioning or refrigeration systems. If the heat recovery system is designed optimally and implemented in residential and small-scale commercial systems, the cumulative benefits would be significant

Households need both refrigeration and water heating. Refrigeration at temperatures below 4°C Is employedfor food preservation, while hot water at temperatures around 55°C is used for bathing and showering.

A home's single largest electricity expense is water heating, which typically accounts for about 40% of their electricity usage. The total energy consumption by geysers will continue to increase as the population grows. As electricity demand increases, the adverse environmental effects and the economic costs associated with electricity generation will also increase.

The vapour compression refrigeration cycle is a common method for transferring heat from a low temperature to a high temperature.

The figure shows the objectives of refrigerators and heat pumps. The purpose of a refrigerator is the removal of heat, called the cooling load, from a low-temperature medium. The purpose of a heat pump is the transfer of heat to a high-temperature medium, called the heating load. When we are interested in the heat energy removed from a low-temperature space, the device is called a refrigerator. When we are interested in the heat energy supplied to the high-temperature space, the device is called a heat pump.

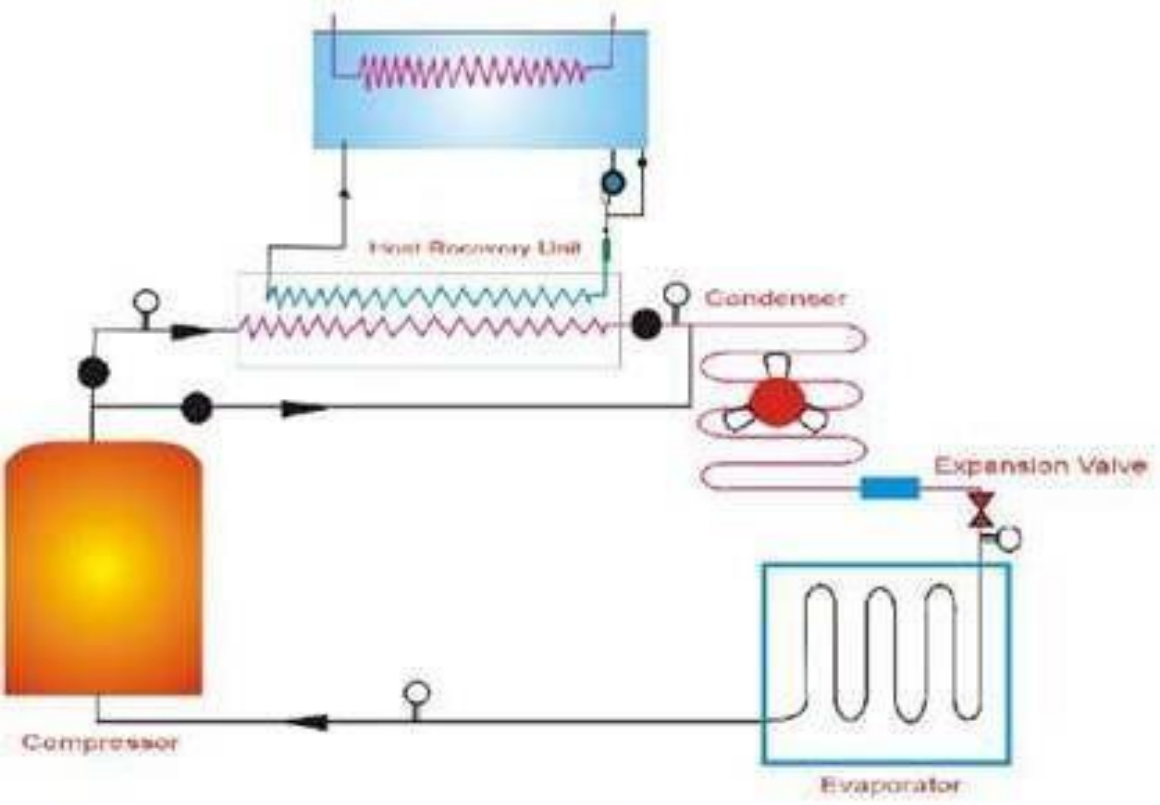


In general, the term heat pump is used to describe the cycle as heat energy is removed from the low-temperature space and rejected to the high-temperature space.

Both refrigerators and heat pumps move heat from a cold thermal reservoir to a warm thermal reservoir. The objective of refrigerators is to remove heat from a cold space whereas the objective of heat pumps is to put heatinto a warm space. Both heat pumps and refrigerators use the same thermodynamic cycle and principles.

When a household refrigerator is operating, it rejects heat into the environment at the condenser and in warm climates that heat is usually wasted. In this paper, the feasibility of a new system which used the rejected heat at the condenser of the refrigerator to heat water in the geyser was investigated.

The figure shows that a vapour compression cycle was used with the evaporator in the refrigerator and condenser in the heat exchanger which was connected to the geyser. Cold and low pressure refrigerant gas entered the compressor where its pressure (and temperature) increased. After the compressor, it then passed through the condenser where it gave up heat at approximately constant pressure to the water in the geyser so that the refrigerant's temperature



A combined vapor-compression refrigeration system and geyser

decreased sufficiently for it to condense into a sub cooled liquid.

After leaving the condenser it went through an expansion valve (which may be a capillary tube). The decrease in pressure in the expansion process caused the refrigerant to turn back into a mixture of liquid and vapour but at a much lower temperature. Then it went to the evaporator where it absorbed heat at approximately constant pressure from the food in the refrigerator.

Simulations

Mr. HARIKRISHNAN R

Automotive

The automotive industry has undergone profound changesin recent years. Cars need to be more fuel-efficient and environmentally friendly. Traditional combustion engines are being replaced by fuel cells, batteries, opposed-piston technologies or electric traction motors. Innovations comeat a high cost, while customers always want the latest innovations at the lowest price.

Innovations require lots of testing using expensive prototypes and equipment. This is where mechanical simulation comes into its own by providing efficient ways to simulate any automotive part or system with a lower overall cost and less time.

Simulation provides an efficient platform for both simulation analysts and designers in one interface, improving the communication between the teams and allowing designers to perform simple simulations upward in the automobile design process.

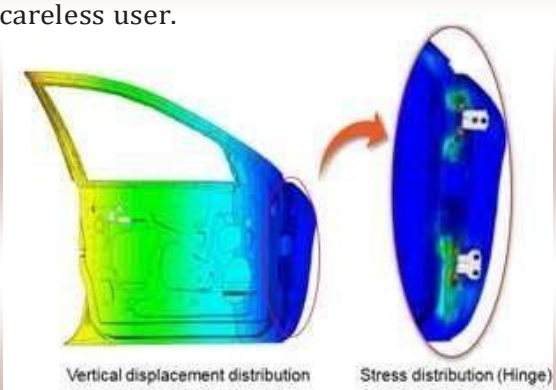
Vehicle door stiffness analysis

Door assembly is a very important part in vehicle design because its frequent interaction with outside world Designers faces so many different problems during the vehicle door design such as weight, cost, excessive reinforcement, water leakage, and etc.FEA analysis can help designers to reduce lead time as well as cost of designand meet various design goals.

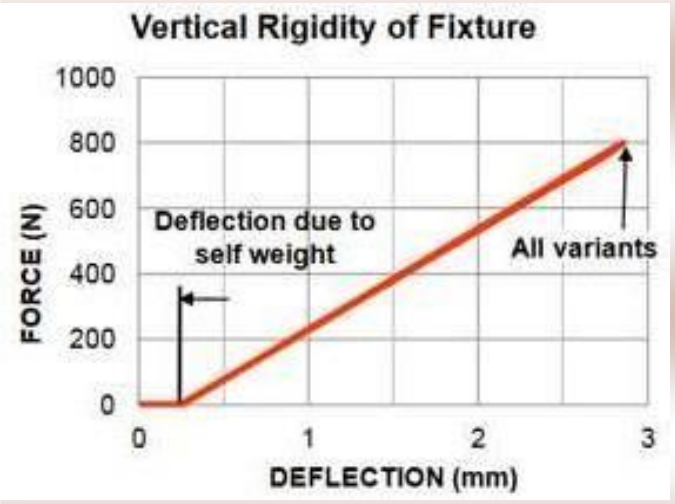
This article introduces two common analysis types performed on vehicle doors Simulation software: Door vertical stiffness analysis and door shell stiffness analysis

Door vertical stiffness analysis

To perform door vertical stiffness analysis, 3 principle issues need to be considered: Firstly, indentify deflection between door and vehicle body due to door's weight. Secondly, indentify total deformation and permanent deformation due to excessive vertical load applied to the door by careless user.



Thirdly, perform vertical load at door latch when door hinge is restrained. By considering these issues, a finite element model is generated as abovepicture. Above analysis is performed by Simulation Software linear static analysis. From the result we can see displacement and stress distribution. By observing stress at hinge part we can indentify if inner panel is damaged.

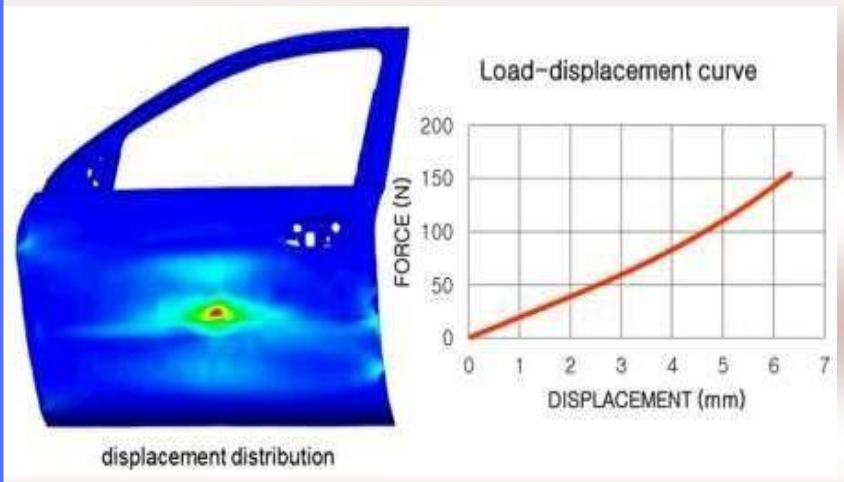


Look at the graphic above. At first the deflection is quite small due to door's self weight. However this deflection become larger when excessive vertical load is applied. Check the elasticity restoration when load is removed and make sure permanent deformation

Door shell stiffness analysis

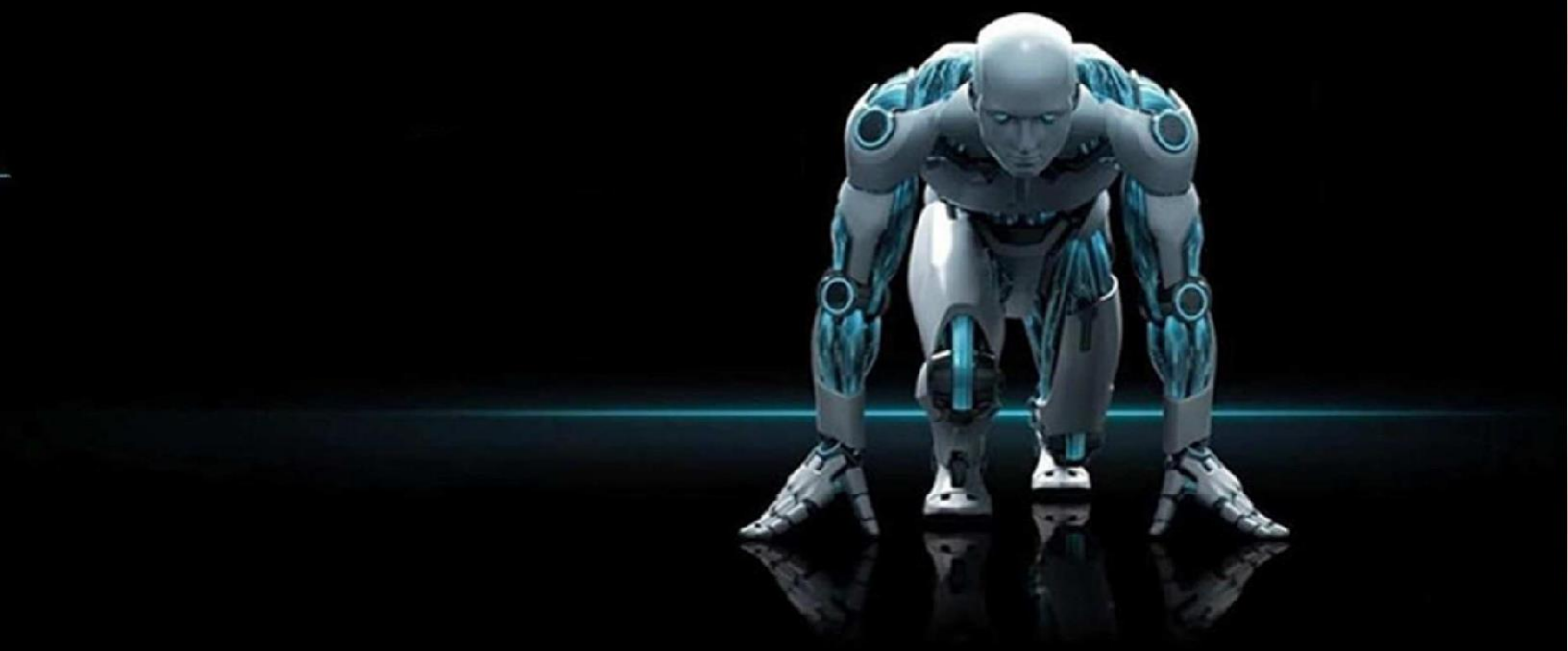
Now we'll discuss door shell stiffness analysis. 2 major Issues in door shell stiffness analysis are:

Firstly, stiffness needs to reach a certain level because of the high frequency of contact with the outside of the doorshell. Secondly, check the deformed shape and permanent deformations due to user's behavior such as kicking the door.



Above analysis is performed by midas NFX linear static analysis. Picture shows door shell's deformation when force is applied to the middle of the car door. And through the load - displacement curve, we can identify the stiffness of the car door shell

Student Articles



Advanced Composite Materials in Aircrafts

Mr.AKSHAY K.(Mech S6 A)

The goal of advanced composite materials is to improve the physical and chemical properties of the materials by altering the present ones.

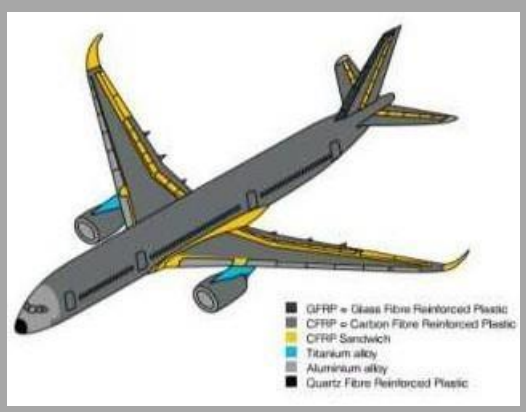
The production of aeroplanes requires ACMs because they are stronger and lighter than conventional materials like aluminium and fibre glass

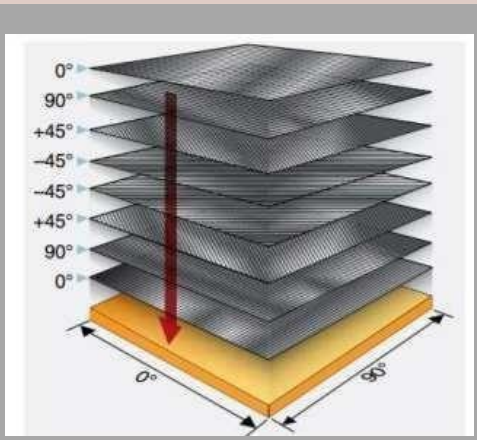
The aerospace industry and the manufacturers' unrelenting passion to enhance the performance of commercialand military aircraft is constantly drivingthe development of improved high performance structural materials.

Composite materials are one such class of materials that play a significant role in current and future aerospace components. Composite materials are particularly attractive to aviation and aerospace applications because of their exceptional strength- and stiffness-to-density ratios and superior physical properties.

Composite materials in aviation came into existence about 60 years ago when boron- reinforced epoxy composite was used for the skins of the empennages of the U.S. F14 and F15 fighters. Although it was only 2% andwas used in secondary structures but as development improved its use in primary structures such as fuselage and wings has increased widely.

As an illustration, the Airbus A350 XWB (Extra Wide Body) is the first aeroplane whose main structural components—the wings and fuselage—are entirely fabricated out of carbon-fiber-reinforced polymer. 53 percent of the components in the A350 are composites, 19 percent are Al/Al-Li, 14 percent are titanium, 6 percent are steel, and 8 percent are other materials.





Not only has this structure improved the aircraft's performance (weight), but also its maintenance and repair procedures. It has been designed to fulfil in-service requirements with benefits such as increased resistance to accidental ground service impacts, simplified damage assessment processes and proven repair solutions.

Advantages of using composite is that they can be formed into more complex shapes then their metallic counterparts, weight reduction, formability, better corrosion resistance and good resistanceto fatigue.

The B2 stealth bomber requires a radar-absorbing material to be added to the exterior of the aircraft with a concomitantweight penalty. Composite materials are therefore used in the primary structure to offset this penalty.

The strength and stiffness of a composite buildup depends on the orientation sequence of the plies. The practical range of strength and stiffness of carbon fiber extends from values as low as those provided by fiberglass to as high as those provided by titanium.

The strength and stiffness of a composite buildup depends on the orientation sequence of the plies. The practical range of strength and stiffness of carbon fiber extends from values as low as those provided by fiberglass to as high as those provided by titanium. This range of values is determined by the orientation of the plies to the applied load. Proper selection of ply orientation in advanced composite materials is necessary to provide a structurally efficient design. The part might require 0° plies to react to axial loads, ±45° plies to react to shear loads, and 90° plies to react to side loads.

Because the strength design requirementsare a function of the applied load direction, ply orientation and ply sequence have to be correct. It is critical during a repair to replace each damaged ply with a ply of the same material and plyorientation. This is makes carbon fiber quasi-isotropic in nature.

Underwater Turbine

by Mr. KIRAN KUMAR S. (Mech S6 B)

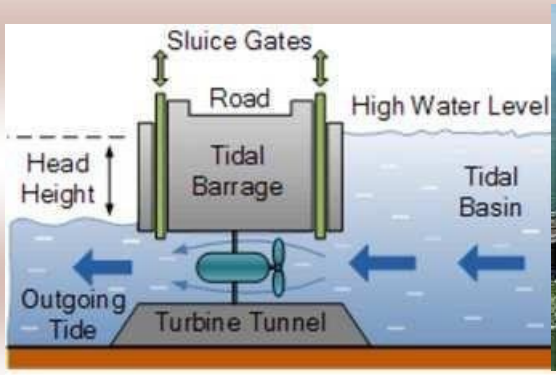
There are several renewable energy sources that are utilised to produce energy, such as solar energy gained by installing solar panels and wind energy collected by installing windmills on fields so that the wind will cause the blades to rotate and produce further electricity.

Similarly this new technique has been coming into practice to the coastal areas where the turbine blades which are used for the wind energy purpose are placed underwater near the coastal areas. Because the coastal area receives the high and low tides due to the gravitational effect by sun and moon and the rotation of earth.

Ocean currents have the tendency to produce more currents as oceans are more dense than air(they are832 times more dense than air),due to which it applies greater force on turbines .

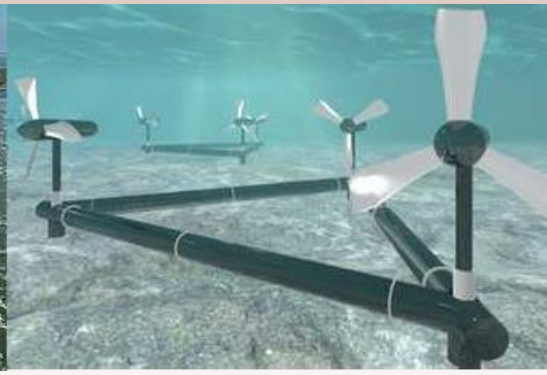
Tidal energy can be produced by many technologies,the major ones are:

1) Tidal barrages
2) Tidal fences
3) Tidal turbines.



Tidal Barrages

Tidal fances



Underwater Turbines

IC Engine with 2-stroke/4-stroke switching during its operation

by Mr. VINAY KRISHNAN (Mech S6 A)

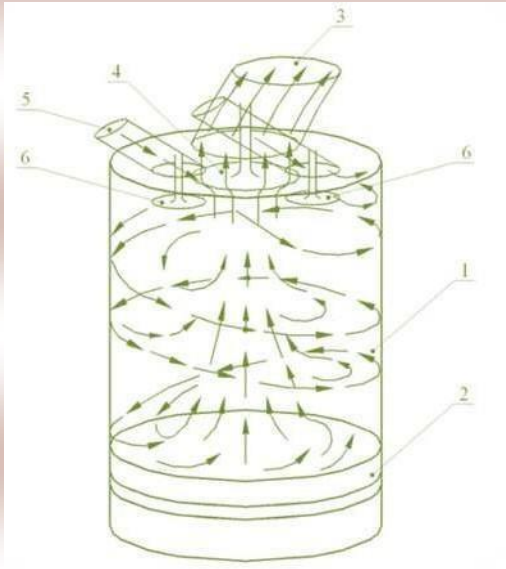
Toggling between a 2 and a 4 stroke internal combustion engine while it is operating. The suggested modifications to standard four-stroke internal combustion engines (ICE) speed up gas exchange and enable switching from a four-stroke to a two-stroke mode while the engine is running (particularly for diesel engines).

The identical inlet and exhaust valves are used for scavenging in both four-stroke and two-stroke modes of operation.

Eligible areas of activity for the proposed innovations are:

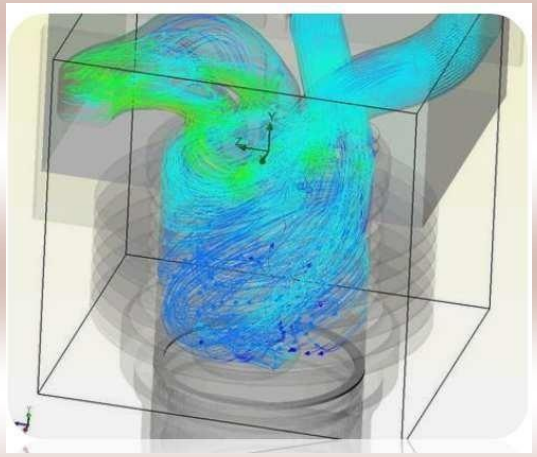
(1) combat tank diesel engines, (2) combat vehicle and heavy army truck diesel engines, (3) heavy truck dieselengines, (4) special purpose vehicles diesel engines (emergency vehicles, fire trucks and others), and (5) engines in electrical generator sets.

The essence of the innovation is to improve gas exchange during the two-stroke mode of engine operation. Four- stroke gas exchange is performed like in ordinary four- stroke diesel engine.



1. Working cylinder
2. Piston
3. Exhaust Passage
4. Exhaust Valve
5. Inlet Passages
6. Inlet Valve

Two-stroke gas exchange is performed through the inlet and exhaust valve unlike scavenging ports in conventional two-stroke diesel engine.Inlet valves 6 are located on of the cylinder head; exhaust valve 4 is along the cylinder axle or with a small offset. The fresh air, preliminary compressed in the engine turbocharger and additionally compressed and cooled in the supercharger with inter- cooler, is supplied into the working cylinder 1 through tangential inlet passages 5 placed at a certain angle to the cylinder head surface. Then the fresh air starts swirling as a dense bed along cylinder walls and displacing to its center and wrings exhaust gases from the cylinder walls toits axle. When the fresh air stream reaches the bottom of piston 2 it turns and expels exhaust gases, concentrated along the cylinder axle, through exhaust valve 4 into the exhaust passage 3.



The fuel pump is selected and adjusted to provide fuel supply in correspondence with the number of working strokes.

Unlike the conventional two-stroke IC engine (especially two-stroke Diesel engine), there are no scavenging ports in the proposed design and no losses of burnt oil through them. It provides the same harmful emission as the emission in conventional diesel engines.

Fields of implementation of the innovation in details

1. **Combat tanks**

Average characteristics of modern combat tanks: a vehicle with the weight ~60 tons; max speed 72 km/h; and acceleration 0-36 km/h for 6 sec. These travel parameters are provided by 1,500 hp power plant, which is either a diesel engine or a gas turbine

. The inconsistency of a tank power plant is that the maximum power is required only for a short time of a combat tank life span – mainly during a combat or occasionally in other cases, while usually tank uses only 700-800 hp for a plain moving its weight at a constant speed and favorable moving conditions. The proposed innovation provides:

- The use of a suitable 1,000–1,500 hp diesel engine produced by any diesel engine manufacturers as a prototype for the power plant of a prospective combat tank. The engine prototype with proposed improvements produces 2,000-3,000 hp for a short time and doubles its power-to-weight ratio during a combat operation;
- The avoidance of designing the entirely new two-stroke diesel engine from scratch;
- Design a combat tank with the highest power-to-weight ratio and dominant maneuverability;
- The possibility of installing an additional fuel tanks inboard to increase the vehicle range without refueling

2. **Trucks**

It is possible to use the proposed improvements for civilian truck diesel engines. There is large market for the trucks with the “boosted” diesel engines like in Latin America, China, India and Southeast Asia (except Japan) countries.

The truck with “boosted” diesel engine gains the ability to reach the given speed 1.7 times faster than with the conventional one. This feature is mostly useful when the truck outstrips the up-front vehicle on a counter traffic lane as well as overcomes the rise without switching the gear and slowing down vehicle speed.

The technology background includes:

1. Patents applications (both PPA and FPA) ready for submission
2. System to compute main characteristics of a targeted engine after its modification.
3. Different Solid Works models of designs, Solid Works COSMOSFLOW Works results, etc.

Special purpose vehical

Tank

Military truck

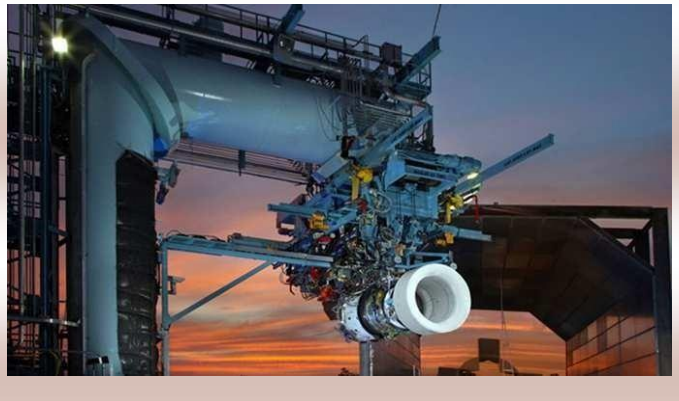
Ultra Efficient Jet Engines

by Mr. ABHINAV P (Mech S6 A)

One of the main factors contributing to the increase in global temperatures and ocean acidification brought on by the release of greenhouse gases such as carbon dioxide into the upper atmosphere of the planet is pollution from aviation. Worldwide, 8.3 million passengers fly every day, which is twice as many as in 1999, burning up to 500,000 metric tonnes of fuel per day. With no much advancement in the alternate fuel research currently same old gasoline is being used causing ever increasing pollution, and many in industry believe the pathway to cleaner jets is through advances in engine technology rather than cleaner fuel.

That's the main idea behind tomorrow's aircrafts with engines that are much lighter, quiter, durable and more energy efficient than the conventional turbofan engines used today in commercial airliners today. Pratt & Whitney is an aerospace manufacturer which has introduced a new series of engines called 'Pure Power' which uses an internal gearbox to slowdown the speed of the fan.

It had it's first run on March 16, 2001. This led to thegeared Turbofan program which was developed with German MTU Aero Engines.



In the Pure Power 1000G engine family, a state of the art gear system separates the engine fan from the low Pressure compressor and turbine, allowing each of the modules to operate at their optimum speeds. This enables the fan to rotate slower and while the low pressure compressor and turbine operate at high speed, increasing engine efficiency and delivering significantly lower fuel consumption, emissions and noise. This increased efficiency also translates to fewer engine stages and parts for lower weight and reduced maintenance costs. This high-bypass geared turbo fan engine is 16% more fuel efficient as well as being up to 75% quieter.

CFM International introduced their LEAP engine intended to compete with Pratt & Whitney PW1000 engine. This engine basically makes use of advanced material composites and different cool air mixing cycles modulating the amount of air flow to the internal passages inside its high pressure turbine to keep the temperature under control. The fan used in the engine has flexible blades manufactured by a resin transfer molding process, which are deigned to untwist as the fans rotational speed increases.

Currently proposed for the LEAP is a greater use of composite materials, a turbine fan in the compressor, a second generation Twin annular Pre Swirl combustor that cuts the nitrous oxide emissions in half, and a bypass ratio around 10:1. The company is using ceramicmatrix composite to build the turbine shrouds.

CFM developed a new carbon-fiber blade whose design involves weaving individual carbon-fiber strands on gigantic Jacquard looms into a complex.

Each individual blade consists of 7 kilometers of carbon-fiber and after being cured in autoclave the finished blade is strong enough that an entire Airbus A350 could be suspended fromit without the blade breaking

CFM uses a ceramic composite matrix (CMC) material consisting of silicon carbide-and-graphite matrix. Each shroud is a ring of 36 tightly fitting white colored CMC parts forming a ring round he inside of the HTP casing outside the circumference of the first HTP rotating stage. Combining all the material advantages these engines are saving fuel by almost 15%.

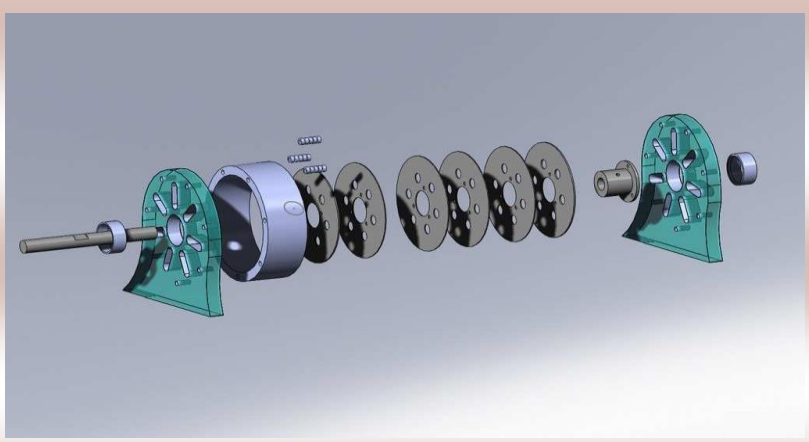
To sum up these new technologies competing each other for the ultra-high efficiencies has made it possible to look into future jet engines or at least bridge the gap between todays and tomorrows engines providing a durable, low maintenance, highly efficient, cleaner, less noisy and advanced engine indicating a reliable future of aircraft industry.

Tesla Turbines

by Mr. ANAS V. K. (Mech S6 B)

Turbomachines are machines which convert fluid energy into rotational motion. Tesla turbine, also called as Prandtl turbine and boundary layer turbine, is a nonconventional turbomachine which operates on the principle of boundary layer. It does not use friction for its working, instead it uses adhesion and viscosity for its functioning. Energy is transferred from fluid to the rotor by dragging discs mounted on the shaft due to boundary layer effect. Fluid flows tangentially towards the discs, follows a spiral path towards the center and exits axially.

The fluid loses its kinetic energy to the discs, thus causing the rotation of rotor. Both compressible and incompressible fluids can be used. The manufacturing of Tesla turbine is much easier compared to the conventional turbines. Also, the turbine is unaffected by the quality of the fluid, thus can be used with fluids containing particulates. A tesla turbine is a reversible turbomachine therefore it can be used as pump. In a pump configuration, the fluid enters axially near the center. The discs provide energy to the fluid, following a spiral pathand thereby exiting from the periphery.



CONSTRUCTION AND WORKING: The Tesla turbine consists of a number of discs mounted parallel to each other on a shaft. Nozzles are located at the periphery of cylindrical casing and tangential to the shaft, pointing toward the inside. The discs are separated by thin gaps for the fluid to pass through it. Exhaust ports are located near the center of the turbine.

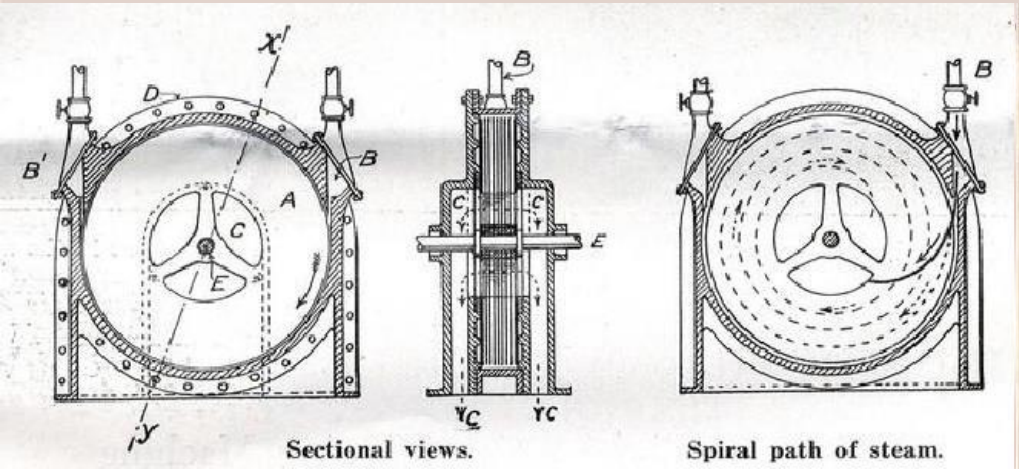
Fluid enters tangentially into the turbine from the periphery. It is made to enter the gap between the discs. The moving fluid drags the discs in the direction of the flow. Due to this there is a transfer of kinetic energy from the fluid to the discs. This transferred energy causes the discs to rotate with the shaft. The fluid thus slows down as it moves towards the centre in a spiral path exiting from the exhaust ports.

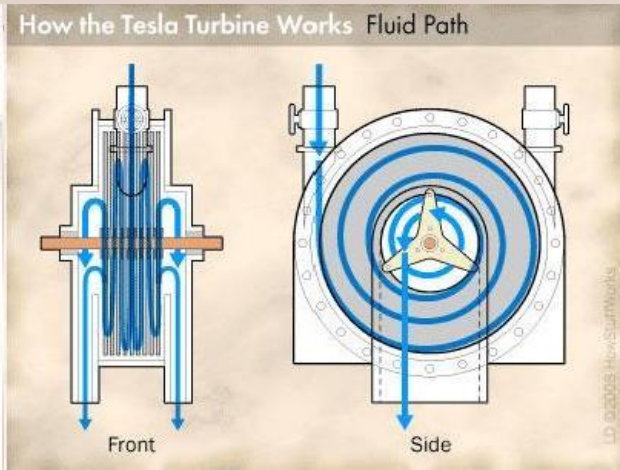
FACTORS AFFECTING PERFORMANCE: Performance of tesla turbine is affected by various parameters. Few of them are:

- Number of discs: The number of discs can be increased to increase the torque obtained.
- Dimension of the discs: The inner and outer radius determine the length of the spiral path followed by the fluid. The more the area of the discs the longer path will be travelled by the fluid.
- Size of the gaps between the discs: The thickness of the gap should be equal to twice the boundary layer thickness.
- Number of nozzles: The torque obtained will be increased if the number of nozzles are increased.
- Reynolds number: The laminar boundary layer thickness depends upon the Reynolds number.
- Velocity of the flow: The velocity of the fluid causes the kinetic energy which is transferred in the turbine.

APPLICATIONS: Tesla turbine was designed to use fluids as motive agents to rotate the rotors. It is found to be useful in low power applications but lacks in performance in high power applications. Many experiments have conducted using tesla turbines for various applications such as steam turbines, turbo for automobiles. One of the most important applications of Tesla turbine is that it can be used where the working fluid contains particulates such as salt water or impure water. It also has applications when working with low and high viscous fluids. Though Tesla turbine has not been successful in finding commercial utilization since its inception, Tesla pump on the other hand has been widely used in applications which require pumping abrasive fluids such as industrial waste etc. Tesla pumps for blood transfusion have become widespread.

CONCLUSION: The tesla turbine is a nonconventional promising technology that is yet to be fully researched and



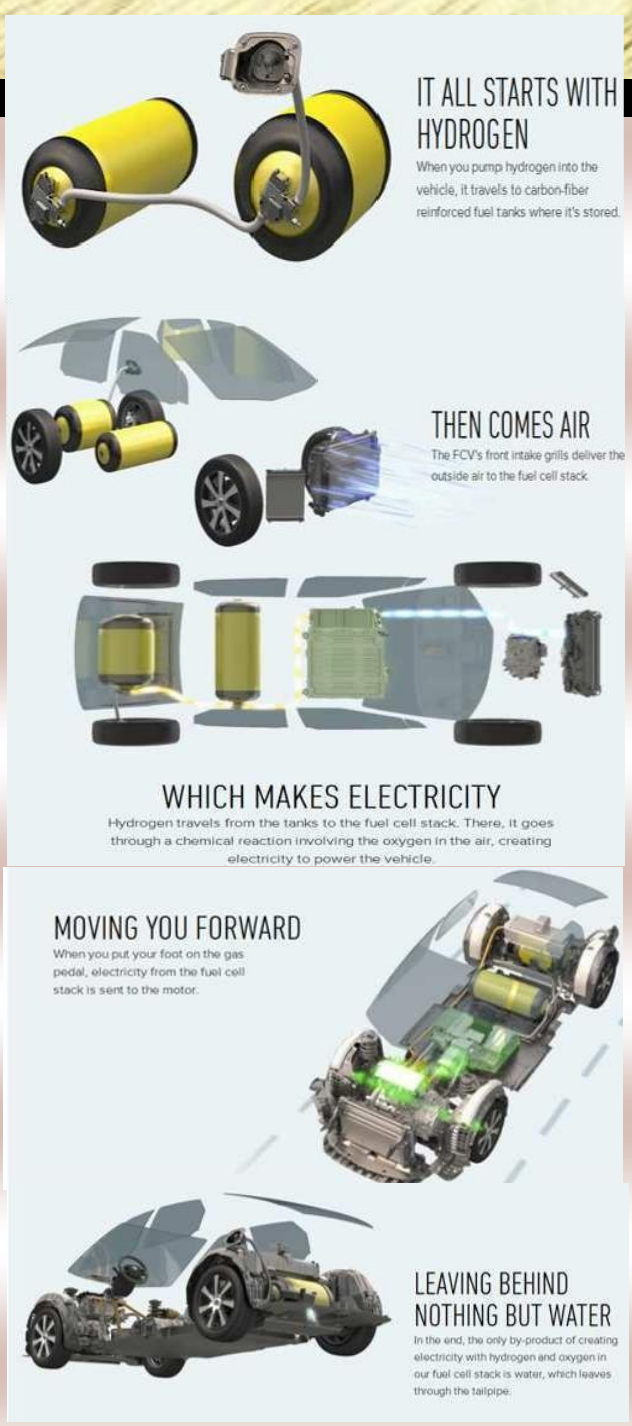


Hydrogen : Future's Fuel

Mr. RISWAN C. . ech)

Used in the fuel cell it is highly efficient and leaves no carbon emission behind. And best of air it is virtually everywhere.it is found everywhere in the plants, water, manure etc.

But the Problem arises before it can be used it has to be separated.



There are a lot of ways to produce hydrogen:-

- Steam reforming:

Steam reforming of methane Is the most common method for the hydrogen production. It combines methane with the high temperature steam to trigger a reaction and separate the hydrogen. At high temperatures (700 – 1100 °C) and in the presence of a metal-based catalyst (nickel), steam reacts with methane to yield carbon monoxide and hydrogen.

$CH4 + H2O \rightleftharpoons CO + 3\ H2$

II. Gasification:

Gasification is a process that converts organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a control.