

GMRIT TECHMAG

Vol:9

2015

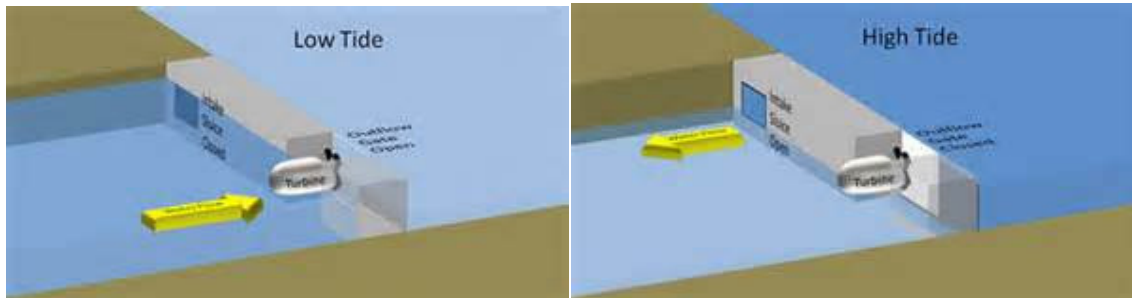


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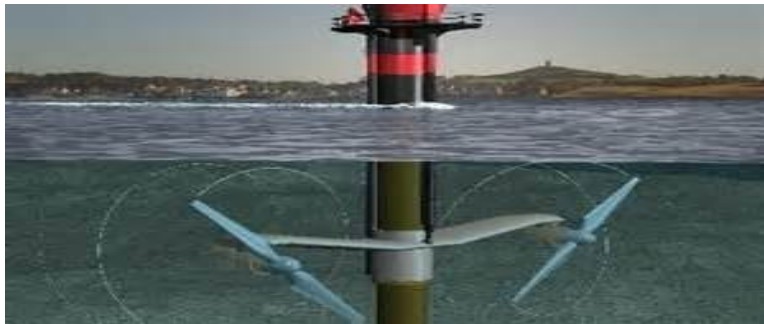
Tidal Power

Sala Geetha Yoshita
13341A0395

Tidal energy comes into existence due to rise and fall of tides when ocean surges. To generate electricity from tides a significant range of power is required between high and low tide.



To utilize tidal power, tidal turbines are developed. They look like under water wind mill and have blades on it. Rotor attached with the turbine use power of moving blades to drive generators that produce electricity.



Ways to use tidal power:

Tides produced by ocean can be used in three different ways to get energy and generate electrical power.



- (1) First, its wave energy or kinetic energy that water gets due to moment of waves, can power turbine if waves rise to a chamber and force the air out from there. Thus, moving air can spin turbine.
- (2) Energy of tides that come into the shore are trapped in a dam and electricity can be generated by operating dam as regular HYDRO ELECTRIC POWER PLANT.
- (3) Ocean's thermal energy helps in generating electricity (temperatures will be different at different depths of ocean).

Advantages:

- Tidal Energy is completely renewable, does not lead to any pollution of the air and does not lead to any carbon emissions like Fossil Fuels.
- The electricity supply is much uniform and reliable in case of Tidal Power.
- It does not need fuel like Thermal, Gas or Oil Powered Power Stations.
- A Tidal Barrage has a very long life of around 100 years which is much longer than that of even Nuclear Power Plants. The long life implies that the life cycle cost of a Tidal Energy Power Plant becomes very low in the long term.

Disadvantages:

- Initial capital income is very high.
- The US DOE estimates that there are only about 40 locations in the world capable of supporting Tidal Barrages. This is because this Tidal Energy Technology requires sizable Tides for the Power Plant to be built. The limited number of locations is a big hurdle.
- Marine life will be disturbed due to this.
- Immature technology is the main disadvantage of tidal power plant.
- Severe Weather like Storms and Typhoons can be quite devastating on the Tidal Power Equipment especially those placed on the Sea Floor.

Conclusion:

Tidal Energy like all other forms of Energy suffers from both advantages and disadvantages. The Tidal Energy phase of development has made the Cons outweigh the Pros unlike other Renewable Energy forms like Wind and Solar Energy. However, innovative methods are being developed to harness Tidal and Wave Energy which might prove to be a game changer and move Tidal Energy into the mainstream Energy Industry.

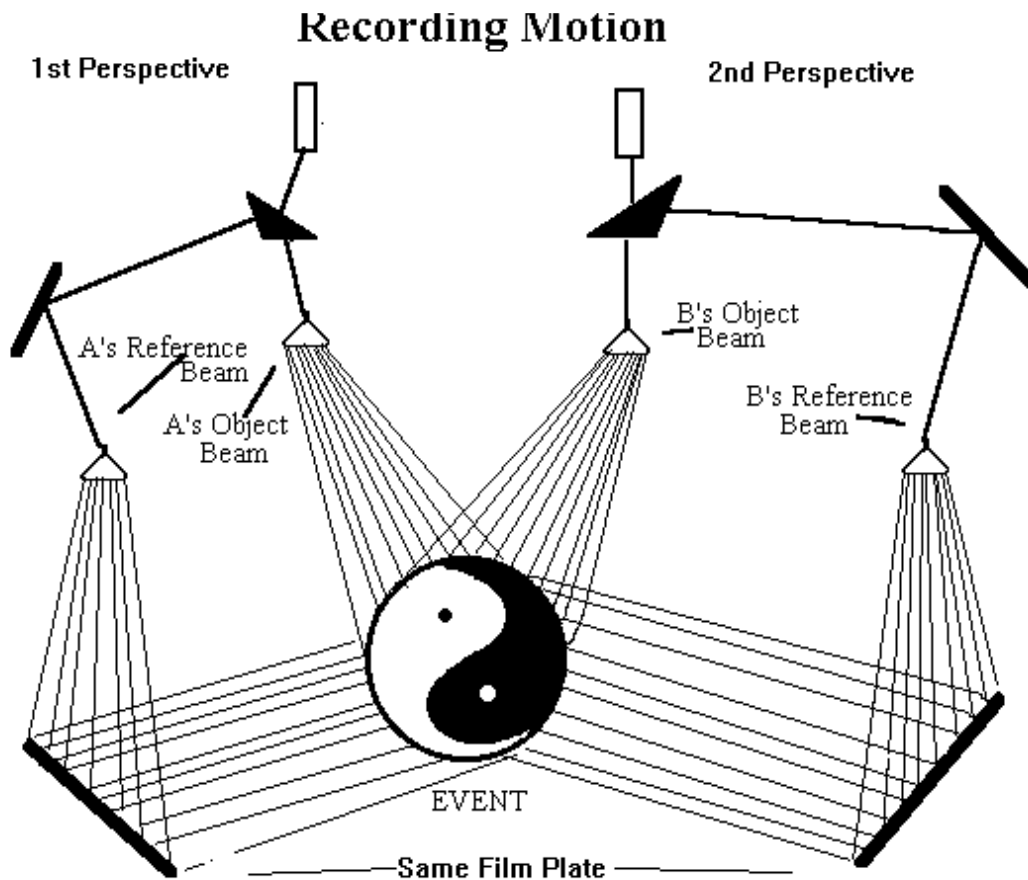
Optical Holography

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Holography is a technique that allows the light scattered from an object to be recorded and later reconstructed so that it appears as if the object is in the same position relative to the recording medium as it was when recorded. The image changes as the position and orientation of the viewing system changes in exactly the same way as if the object was still present, thus making the recorded image (hologram) appears three dimensional. Holograms can also be made using other types of waves

The technique of holography can also be used to optically store, retrieve, and process information. While holography is commonly used to display static 3-D pictures, it is not yet possible to generate arbitrary scenes by a holographic volumetric display.



Holograms that simply redirect light may be used as inexpensive optical elements, serving in place of lenses and mirrors. To cite one popular application, laser readers of the Universal Product Code on groceries use a spinning disc outfitted with a number of holographic lenses. By continuously providing many angles of laser scanning, the product code can be identified even when the item is passed casually over the scanner. A telephone credit card used in Europe has embossed surface holograms which carry a monetary value. When the card is inserted into the telephone, a card reader discerns the amount due and deducts (erases) the appropriate amount to cover the cost of the call. Supermarket scanners read the bar codes on merchandise for the store's computer by using a holographic lens system to direct laser light onto the product labels during checkout.

Now a day's hologram is used in various aspects such as defense and authentication. Even we can say that the using of hologram to store data increases its span of quality. It can be also used in education for practical view. It makes education more enthusiastic and also makes simple way of teaching. If we implement on daily usage work will be so easy.

How to Show Our Respect towards Women

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Recently, we have celebrated women's day. But, what is the use of it when we see thousands of harassment cases in India on women?. Particularly, teenagers are the main victims of sexual harassment. They are facing many problems. All are making public speeches about women. But, women don't want speeches and praising words. Instead of that, they want to be treated as human beings. but some are understanding this in a different manner .

What is meant by equality? It means not giving importance to everyone in a same manner it just give equal priority irrespective of their genders . Because, the equality can't be seen even in twins. Also we can't see 100% equal identities in them . Then how can we ask equality in opposite genders? so we should give importance in other aspects like giving justice for victims in sexual harassments. At this particular instant, justice for women who are facing problems is the key issue. Those who are saying they are for women welfare they are just talking in that particular time when the problem persists. But, they are not bothering whether their problem is really solved or not. Fortunately, some men are also contributing their time for the women welfare.

Gandhiji said that when women walk in the roads at late night that is the real independence. but not at late nights, even in day time also they are feeling insecure. when girls are walking on the roads, they are seen as a just sex objects. Recently, Mukesh Singh who is accused in Nirbhaya case, when he giving interview to one reporter, with no guilt, said that "why the girl has to come at that time to see a movie with a boy friend? Is it necessary for a girl to come outside at nights? The dressing style of girls also should be changed". by these words we can understand how some are thinking and even showing their attitude towards women .

Many students come onto roads and fought for the justice in Nirbhaya case . It is the true condolence to Nirbhaya. we came to know how cruelly and brutally they raped Nirbhaya and killed her by causing lot of physical harassment. Just for few minutes of their happiness they showed her the hellish tortures. we all hear this news after some days we forget it . But the thing we are ignoring is, this is happened at country's capital so we know it, but so many incidents like Nirbhaya are happening our country before and after Nirbhaya act.

How can we stop this? No answer. Even the government is also taking actions but those actions cannot stop the criminals completely. even minor(below 10 years) girls are also victims in rape cases . We see it as breaking news that's it. we always we are boosting the boys not to cry .But, we should teach them not make a girl to cry. The situation may change then. This

attitude should come from childhood. If a father beats mother the child may think that the men are always superior than women and they can do anything .this is true not only in rape cases but also in women harassments .

“just once think in a open mind the man should have a woman in every stage of his life. first coming to his birth , the woman should have the baby in her womb in 9 months .after 9 months with lot of labor pains and complications she will give birth. as a mother she feed you ,she cares you .in adult age, the girl should be your life partner by supporting every aspect . Till the end of our life without a woman man cannot live”. Instead of that, what are we doing? In return, they are expecting protected life.

Firstly, one will see the baby in mother's womb is girl or boy. If it is girl we are just killing it in the womb itself. when the girls are in teenage they are facing eve teasing , sexual harassments. Men are behaving like animals with girls. Acid attacks are also increased on girls.

Finally, my aim to not criticize every man but also just want to say what is woman , how important she is in his life. Government should take severe actions against the culprits behind the harassment, not just sending them to jail but also punish them severely. By seeing them remaining people have to feel fear even when they come across that kind of thought to create problem for girls!

Self Driving Cars

B.Shiva Prasad (13341A1207)

Abstract:

Since its inception of the commercial auto industry in the late 1890s, cars have become increasingly safe and convenient. Recently, carmakers have begun to introduce advanced driver-assistance systems such as adaptive cruise control (which automates accelerating and braking) and active lane assist(which automates steering.) These systems have become capable enough that new luxury vehicles can drive themselves in slow-moving highway traffic. Research into autonomous cars has progressed remarkably since the first demonstrations in the 1980s. In 2010, four driverless vans traveled from Italy to China. In August of 2012, Google announced that its self-driving cars had completed over 300,000 miles of accident-free autonomous driving. Although self-driving cars may still seem like science action, Google, many industry analysts, auto suppliers, and carmakers project that such cars will be available before 2020.

Background and Observation

For generations, the automobile industry has been a source of innovation and economic growth. The ability to drive is a symbol of mobility and independence that spans generations. Clearly, automobiles play a significant role in our lives and afford many benefits to society.

Yet for all the benefits conferred on society, no other invention in the history of civilian technology has caused as much harm as the automobile. Every 30 seconds, someone dies in a traffic accident, adding up to well over 1 million deaths each year¹. In the U.S., automobile accidents are the leading cause of death for people between the ages of 3 and 34. Moreover, human error is the cause of over 90% of automobile accidents.

Disruptive: Google

The most deeply involved player in the autonomous automobile market from outside of the automobile industry is Google. Google has worked to develop autonomous cars for the past six years. CEO Larry Page approaches this as a “big bet” problem, noting the high accident rate, very low utilization of existing vehicles and the cost of car parking facilities⁶. Google’s motivation for the car, as described by the lead developer of the project Sebastian Thrun are captured in the sidebar, Benefits of the Driverless Car³. Google’s stated mission is to “organize the world’s information and make it universally accessible and useful.” It is approaching autonomous vehicles as an opportunity to organize and process mapping and geographic information to many mobile computers - the vehicles themselves. Google sees this problem as parallel to the technical infrastructure and techniques required to organize very large, complex and rapidly changing data sets such as the Internet.

Self-driving cars – available now:

New features are typically introduced first in high-end automobiles before eventually trickling down to mainstream models. For the last 40 years, Mercedes Benz strategy has been to introduce innovations in their flagship S-Class (Sonderklasse or "Special class") first. Many features taken for granted today were first piloted in the S-Class, including padded interior in 1972, ABS 1978, air bag and seatbelt pre-tensioned in 1981, passenger airbag in 1988 and electronic stability control in 1995. The 1998 S-Class introduced Diatonic, a cruise control system with sensors for measuring and maintaining the vehicle's distance from the car in front of it.

The 2013 S-Class model is no exception to this 40-year-old strategy. It takes a decisive step toward autonomous driving, as it is capable of steering itself. This makes it the first to fulfill all the criteria of what is constituted as fully automated driving. However, it will do so only in congested traffic. When the vehicle is traveling at walking speed, the driver can choose to switch on cruise control and take his or her feet off the pedals and hands off the steering wheel. The car then automatically accelerates, brakes and steers. The Intelligent Drive: How it Works graphic highlights the technology subsystems involved to achieve "self-driving" status¹¹.



Ford¹² and GM¹³ have announced similar systems, called Traffic Jam Assist and Super Cruise respectively, which they expect to release between 2015 and 2017. Audi has a similar system which is rumored to be planned for the 2016 Audi A8.

Environmental Factors

Driving a car requires more than simply a car and a driver. A state issued license is needed as well as the appropriate regulatory framework, insurance and infrastructure. The political, environmental, and social impacts of autonomous cars are wide-ranging; there is much incentive behind enabling autonomous vehicles that will move the industry towards autonomous vehicles. However, there are also several concerns about autonomous vehicles that may impede adoption of the technology.

Positive: Safety

As discussed previously, the human toll associated with automobiles is sobering, and the vast majority of preventable deaths are attributable to human error. Furthermore, with projected wealth increases in developing economies, the number of cars and drivers, and therefore the number of fatalities, is expected to increase. The World Health Organization estimates that road traffic injuries will become the fifth leading cause of worldwide death by 2030, accounting for 3.6% of the total—rising from the ninth leading cause in 2004, when it accounted for 2.2% of the world total²².

The economic impact of car accidents is also significant. According to research from the American Automobile Association (AAA), traffic crashes cost Americans \$299.5 billion annually.

Summary

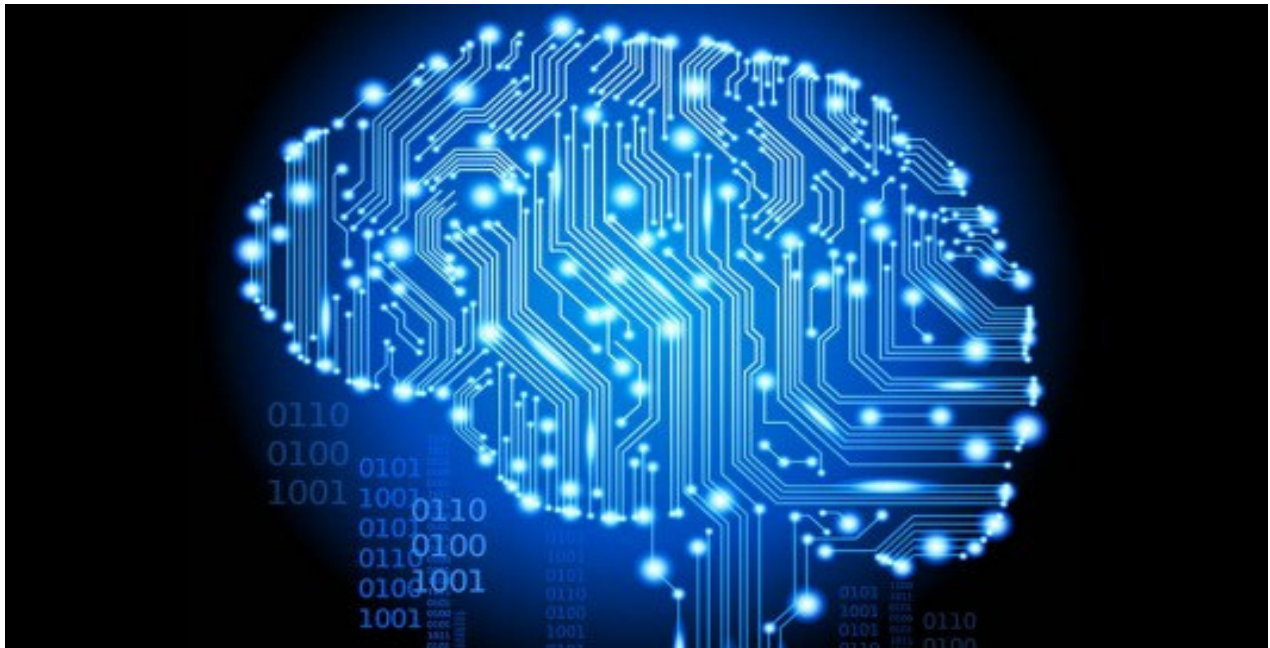
In conclusion, there are many strong socio-economic motivators for the adoption of autonomous vehicles. Human safety, infrastructure efficiency, quality of life and a ready customer base are just a few of the key factors that will help make self-driving cars a reality. Technology is converging rapidly, both incrementally from existing vendors and from new entrants. A car equipped with existing systems can take in more information quickly and reliably, and then process it to implement a correct decision about a complex situation. Yet to be solved are the complex issues associated with the legal and liability infrastructure. Gradual introduction of these features combined with strong economic motivators are sure to overcome such obstacles. The future will surely include autonomous vehicles; the only question is how quickly.

Blue Brain Theory

V.Ramya II-IT 13341A1237

Blue brain –The name of the world’s first virtual brain. That means a machine that can function as human brain. Today scientists are in research to create an artificial brain that think, response, take decision and keep anything in memory. The main aim is to upload human brain into machine. So that man can think, take decision without any effort. After the death of the body, the virtual brain will act as the man. so, even after the death of a person we will not loose the knowledge, intelligence, personalities, feelings and memories of that man that can be used for the development of the human society.

INTRODUCTION:



No one has ever understand the complexity of human brain. It is complex than any other circuits in the world .So question may arise “Is it really possible to create a human brain ?”The answer is “yes”. Because, whatever man has today ,he has always followed the nature .When man does not have a device called computer , it was a big question for all of it is really possible due to technology. Technology is growing faster as IBM is now in research to create a virtual brain .It is called “Blue brain”. In near years, This would be the first virtual brain of the world.

HISTORY OF THE BLUE BRAIN:

The aim of the project, founded in MAY 2005 by the Brain and mind Institute of the ecole polytechnique Federate de Lausanne is to study the brain's architecture's director, Henry Markram using a Blue gene supercomputer running Michal Hines's NEURON software ,The simulation does not consist simply of an artificial neural network ,but involves a biologically realistic model of neurons. It is hoped that it will eventually shed light on the nature of consciousness. there are a number of sub-projects, including the cajal Blue Brain, coordinated by the supercomputing and visualization center of Madrid, and others run by universities and independent laboratories.

GOALS:

- 1.Neocortical column modeling
- 2.Whole brain simulation
- 3.Progress
- 4.Uploading Human Brain

ADVANTAGES:

- 1.we can remember things without any effort.
2. making decision without the presence of a person is possible.
3. we can use the intelligence of a person after his/her death.
4. understanding the activities of animals is possible.
- 5.allowing the deaf to hear direct nerve stimulation is achievable.

LIMITATIONS:

1. we become dependent on the computer.
2. others may use technical knowledge against us.
3. another fear is found today with respect to human cloning.
4. in addition there seem to be power constraints. the brain consume about 20W of power where as super computer may use as much as 1MW or an order of 100,000 more(Note: Landauer limit is 3.5×10^{20} op/sec/watt, at room temperature).

REQUIREMENTS_HARDWARE AND SOFTWARE:

- 1.A super computer.
- 2.Memory with a very large storing capacity.
- 3.Processor with a very high processing power

.

4.A very wide network.

5.A program to convert the electric impulse from the brain to input signal, which is to be received by the computer and vice versa

.

6.Very powerful Nanoboats.

CONCLUSION:

The whole idea is that mental illness, memory and perception triggered by neurons and electric signals could be soon treated with a supercomputer that models all the 1,000,000 million synapses of brain. The key finding is that irrespective of gender and race, human brains are basically identical. We will be able to map the differentiations by nuancing the patterns later. The exciting part is not how different we are but how similar we all are. There are good reasons to believe that, regardless of implementation strategy, the prediction of realizing artificial brains in the near future are optimistic.

SCREENLESS DISPLAYS

B. Saiteja, IT-Department

INTRODUCTION:

What is Screenless Display?

Screenless Display was an excellent thought that came into many experts in order to solve the major problems related to the device miniaturization. Screenless Displays can be defined as a display which helps to display and even transmit any information without the aid of screens.



Screenless Display

Screenless display is the present evolving technology in the field of the Computer-enhanced technologies. It is going to be the one of the greatest technological developments in the coming future years. Screenless display technology has the main aim of displaying (or) transmitting the information without any help of the screen (or) the projector. Screen less displays have become a new rage of development for the next GEN-X. Screenless videos describe systems for transmitting visual information from a video source without the use of the screen.

Screenless Display types can be divided mainly into 3 groups:

- visual image
- Retinal direct.
- Synaptic interface.

VISUAL IMAGE SCREENLESS DISPLAY:

Visual Image is a type of screenless display where the eye or the retina can recognize any

screenless image. Holographic display, Virtual Reality Goggles and Heads Up Display are some present visual image screenless display examples. The display works on the principle that; light gets reflected by the intermediate object before reaching the retina. The intermediate object can be holograms, windows, or even LCDs. The most common example of Visual Image screenless display is a Hologram.



Hologram

Holograms were used mostly in telecommunications as an alternative to screens. Holograms could be transmitted directly, or they could be stored in various storage devices (such as holodiscs) the storage device can be hooked up with a holoprojector in order for the stored image to be accessed .

Virtual Reality Goggles (VRG)

virtual reality goggle (which consists of two small screens but is nonetheless sufficiently different from traditional computerscreens to be considered screenless) is an eyewear display device. Wearer can view and interact with a series of computer generated images. It consists of display screens in front of face. Images can be projected with sound and video, allowing it more popular for entertainment applications. Presence of polarized lenses is the major feature of VRG.



Heads Up Display (HUD):

Heads-Up display in airplanes (which display images on the clear cockpit window) are included in Visual Image category. An ordinary HUD contains a projector unit, combiner and a computer

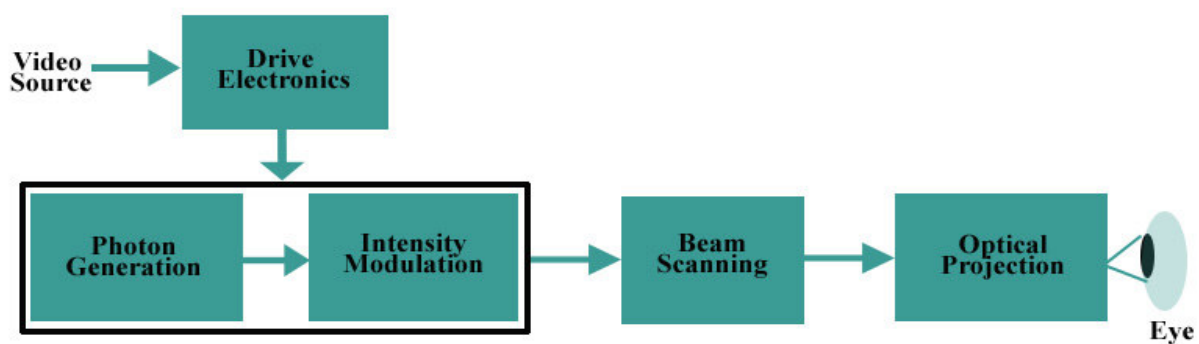
as its components. Projector Unit will project the image and the combiner will redirect the projected image such that we can see the field of view and the projected image at the same time. Computer is an interface between projector unit and data to be displayed.



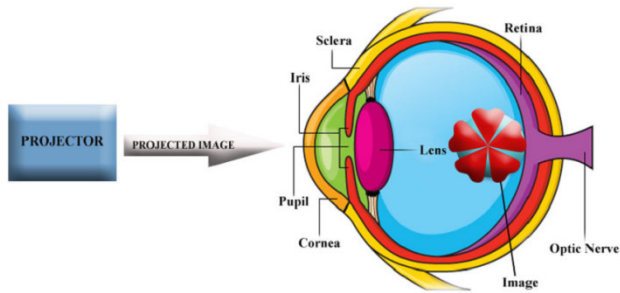
HUD in car

Retinal display:

Virtual retinal display systems are a class of screenless displays in which images are projected directly onto the retina. They are distinguished from visual image system because light is not reflected from some intermediate object onto the retina; it is instead projected directly onto the retina. Retinal Direct systems, once marketed, hold out the promise of extreme privacy when computing work is done in public places because most snooping relies on viewing the same light as the person who is legitimately viewing the screen, and retinal direct systems send light only into the pupils of their intended viewer.



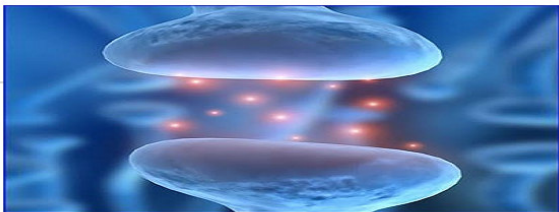
Retinal Display block diagram



Retinal Projection

Synaptic Interface:

Synaptic Interfaces does not use light at all and the visual image is directly given to the brain. The technology is in the advancement mode and it is now been tested on humans too. This is useful for security system, effective communication, education, business, planning and broadcast. Success was achieved in sampling video signals from eyes of horseshoe crab through their nerves. Also, the video signals from electronic cameras into the creatures' brains were also sent successfully.



Best Upcoming Screenless Display Technologies:

Screenless Display Technologies: It may sound like an oxymoron, but a screen-less display is a kind of technology that could be utilized in the very near future. Scientists and technology firms are finalizing a range of devices and forms of technology that allow you to view images without the use of a screen. These devices come in the form of projection devices and hologram machines, and whilst they all offer something different, they are all a part of the next generation of technology.

Google Glass:

The first screen-less display that needs mentioning is Google Glass. This device has been tested for the past year, and some lucky individuals have even got their devices already. Google Glass sits on the face like a pair of glasses, and on one eye it has a block of glass that allows you to see augmented reality. Images can be displayed right in front of your eye, as well as text and information about objects and places that are in front of you. This technology is only in its early stages, but definitely shows that screenless displays will become a natural form of media consumption in the future.



ADVANTAGES AND DISADVANTAGES OF THE TECHNOLOGY:

- 1. Lower power requirements:** The six diodes require no more than a few millionths of a watt to deliver their images to the user's eyes.
- 2. Higher resolution images:** The pixels in the images projected by the diodes can be made smaller than is possible with any CRT or flat panel display, so higher resolution can be achieved. With retinal projectors the only limitation in the resolution of visual images will be the resolving power of the users' eyes.
- 3. Greater portability:** The combination of diodes, lenses, and processing components in a retinal projector system will weigh only a few ounces.
- 4. Wider angle of view:** Retinal projectors will be able to provide a wider field of view than is possible with display screens.
- 5. Better color accuracy:** By modulating light sources to vary the intensity of red, green, and blue light, retinal projectors can provide a wider range of colors – and more fully saturated colors – than any other display technology.
- 6. Greater brightness and better contrast:** Retinal projectors can provide higher levels of contrast and brightness than any other display system.
- 7. Ability to present 3D images:** With their capability of presenting high-definition image-pairs, retinal projectors can deliver the most highly realistic stereoscopic movies and still

pictorial images to their users.

8. Ability to present far-point images: The human visual system is a far-point system. With today's desktop and laptop computers users must employ their near-point vision. The excessive use of our near-point vision in using computers, reading, sewing, playing video games, etc., is making myopia a very common impediment. The use of the far-point images that can be provided by retinal projector systems could reduce the incidence of myopia and, hence, the growing need for and use of eyeglasses.

9. Lower cost: The present cost of retinal projector systems is high. But there are no difficult manufacturing problems in mass producing low-cost components, so inexpensive systems will soon become available. Disposal and environmental costs of these tiny delivery devices will also be minimal because toxic elements such as lead are not used in their manufacture.

DISADVANTAGES:

- The principle disadvantage is that Virtual retinal display (VRD) is not yet available in the significant number.
- Prototypes and special experimental models are now being Built, but their cost per unit is high.
- The VRD technology is still under progress and Development.

FUTHER SCOPE:

- Japanese scientists have invented the pair of intelligent Glasses that remembers where people last saw their keys, Handbags, iPod, and mobile phones.
- Smart Google is developing the compact video camera which films everything the wearer looks at the information what the viewer wants will be directly being seen in through the glasses where there is no screen or projector present.
- Adobe Systems are working to bring out more innovations. It is said that by 2020, the world will become a virtual one and more exciting.

CONCLUSION:

Due to the ability of having several advantages which are needs plenty of knowledge and process for the development is still under the improvement. May be in the future the world may be dominated with the screen less display technologies and this enriches the world of technological empowerment in the field of the computer technology. Screenless displays promises the cost effective aspect and also brighter future in the computer technology.

Advantage of Ecommerce

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Department of Power Engineering

Given below is a large list of advantages and disadvantages of ecommerce. This list will help you look beyond the hype and develop your own perspective of the true value of ecommerce: to businesses and to consumers. Interestingly there are many advantages for consumers that might actually be a disadvantage for ecommerce businesses

1. Pro: No Standing in Queues or Being Placed on Hold Forever

For customers, this is one of the most popular conveniences of ecommerce.

2. Con: Lack of Personal Touch

I miss the personal touch and relationship that develops with a retail store. In comparison, ecommerce is far more sterile.

3. Pro and Con: Easier to Compare Prices

There are several shopping search engines and comparison shopping websites that help consumers locate the best prices. While buyers love this, sellers find it too restrictive as many of them get filtered out of the consumer's consideration set.

4. Pro: Access to Stores Located Remotely

Especially for people who are not situated in major urban centers, this can be a big advantage. Likewise ecommerce opens new markets for ecommerce businesses.

5. Con: Inability to Experience the Product Before Purchase

There are many products that consumers want to touch, feel, hear, taste and smell before they buy. Ecommerce takes away that luxury.

6. Pro: No Need for a Physical Store

Since there is no need for a physical store, ecommerce businesses save on one of the biggest cost overheads that retailers have to bear.

7. Con: Need for an Internet Access Device

Ecommerce can only be transacted with the help of an Internet access device such as a computer or a smartphone.

8. Con: Need for an Internet Connection

Not just does one need an access device; one also needs Internet connectivity to participate in ecommerce.

9. Pro and Con: Common Availability of Coupons and Deals

Though there is nothing about ecommerce that makes it intrinsically oriented to discounts, the way online business has evolved has led to lowered prices online. This is an advantage for the buyer, but a disadvantage for the seller.

10. Overcome Geographical Limitations

If you have a physical store, you are limited by the geographical area that you can service. With an ecommerce website, the whole world is your playground. Additionally, the advent of Ecommerce, i.e., ecommerce on mobile devices, has dissolved every remaining limitation of geography.

11. Gain New Customers With Search Engine Visibility

Physical retail is driven by branding and relationships. In addition to these two drivers, online retail is also driven by traffic from search engines. It is not unusual for customers to follow a link in search engine results, and land up on an ecommerce website that they have never heard of. This additional source of traffic can be the tipping point for some ecommerce businesses.

12. Lower Costs

One of the most tangible positives of ecommerce is the lowered cost. A part of these lowered costs could be passed on to customers in the form of discounted prices. Here are some of the ways that costs can be reduced with ecommerce:

- Advertising and Marketing Organic search engine traffic, pay-per-click, and social media traffic are some of the advertising channels that can be cost-effective.
- Personnel The automation of checkout, billing, payments, inventory management, and other operational processes, lowers the number of employees required to run an ecommerce setup.
- Real Estate this one is a no-brainer. An ecommerce merchant does not need a prominent

13. Locate the Product Quicker

It is no longer about pushing a shopping cart to the correct aisle, or scouting for the desired product. On an ecommerce website, customers can click through intuitive navigation or use a search box to immediately narrow down their product search. Some websites remember customer preferences and shopping lists to facilitate repeat purchase.

14. Eliminate Travel Time and Cost

It is not unusual for customers to travel long distances to reach their preferred physical store. Ecommerce allows them to visit the same store virtually, with a few mouse clicks.

15. Provide Comparison Shopping

Ecommerce facilitates comparison shopping. There are several online services that allow customers to browse multiple ecommerce merchants and find the best prices.

16. Enable Deals, Bargains, Coupons, and Group Buying

Though there are physical equivalents to deals, bargains, coupons, and group buying, online shopping makes it much more convenient. For instance if a customer has a deep discount coupon for turkey at one physical store and toilet paper at another, she may find it infeasible to avail of both discounts. But the customer could do that online with a few mouse-clicks.

17. Provide Abundant Information

There are limitations to the amount of information that can be displayed in a physical store. It is difficult to equip employees to respond to customers who require information across product lines. Ecommerce websites can make additional information easily available to customers. Most of this information is provided by vendors, and does not cost anything to create or maintain.

18. Create Targeted Communication

Using the information that a customer provides in the registration form, and by placing cookies on the customer's computer, an ecommerce merchant can access a lot of information about its customers. This, in turn, can be used to communicate relevant messages. An example: If you are searching for a certain product on Amazon.com, you will automatically be shown listings of other similar products. In addition, Amazon.com may also email you about related products.

19. Remain Open All the Time

Store timings are now 24/7/365. Ecommerce websites can run all the time. From the merchant's point of view, this increases the number of orders they receive. From the customer's point of view, an "always open" store is more convenient.

20. Create Markets for Niche Products

Buyers and sellers of niche products can find it difficult to locate each other in the physical world. Online, it is only a matter of the customer searching for the product in a search engine. One example could be purchase of obsolete parts. Instead of trashing older equipment for lack of spares, today we can locate parts online with great ease.

Non Destructive Testing Using GPR and its Applications in Civil Engineering

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What is NDT?

Non-destructive testing (NDT) methods are techniques used to obtain information about the properties or internal condition of an object without damaging the object. Non-destructive testing is a descriptive term used for the examination of materials and components in such way that allows materials to be examined without changing or destroying their usefulness. NDT is a quality assurance management tool which can give impressive results when used correctly. It requires an understanding of the various methods available, their capabilities and limitations, knowledge of the relevant standards and specifications for performing the tests. NDT techniques can be used to monitor the integrity of the item or structure throughout its design life.

Necessity of NDT:

The greatest disadvantage of the conventional methods of testing lies in the fact that the required results cannot be obtained without damaging the actual structure. As a result, for the purposes of cost optimization, the need for Non-Destructive Testing (NDT) and inspection during the manufacturing, construction and the operation stage is both inevitable and invaluable.

Methods of NDT:

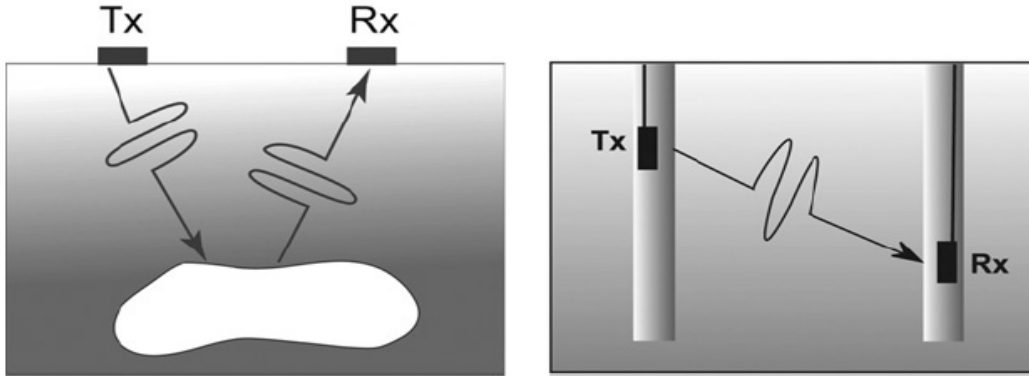
There are different methods of analyzing the targets or structures using the NDT. Some of them are:

1. GROUND PENETRATING RADAR(GPR).
2. ULTRASONIC IMAGING.
3. VIBRATION ANALYSIS.
4. ACOUSTIC EMISSION ANALYSIS.
5. INFRA RED THERMOGRAPHY.

GROUND PENETRATING RADAR – (GPR)

GPR is now a well accepted technique. The foundations of GPR lie in

THE ELECTROMAGNETIC THEORY. The most common form of GPR measurements deploys a transmitter and a receiver in a fixed geometry, which are moved over the surface to detect reflections from subsurface features.



PICTURE SHOWING THE PRINCIPLE OF GPR

The wave properties are based on the MAXWELL'S LAWS.

$$\nabla \times \overline{E} = - \frac{\partial \overline{B}}{\partial t}$$

$$\nabla \times \overline{H} = \overline{J} + \frac{\partial \overline{D}}{\partial t}$$

$$\nabla \cdot \overline{D} = q$$

$$\nabla \cdot \overline{B} = 0$$

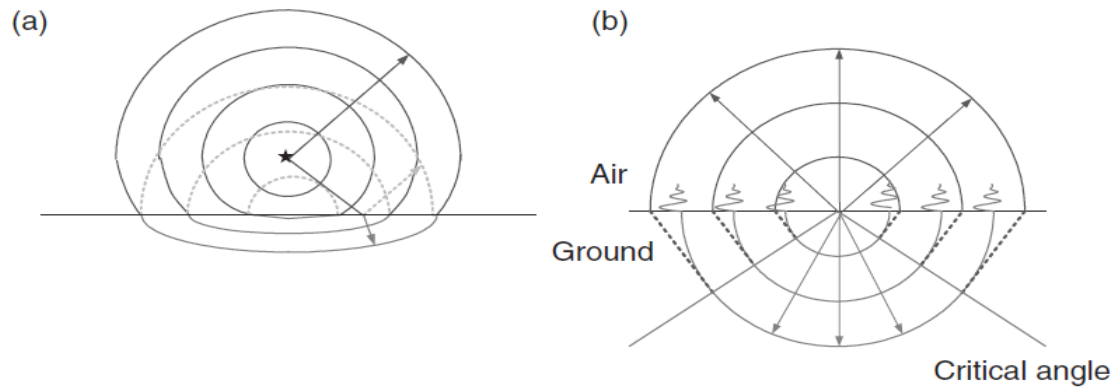
Where $\overline{E}$: Electric field vector., q: Electric charge density,

$\overline{B}$: Electric flux density, $\overline{D}$: Electric displacement vector

T is the time of travel, $\overline{H}$: magnetic field intensity.

Position of the source:

GPR sources are normally deployed close to the ground. The following figure depicts how the wave front from a finite source impinges on the ground. The field at any point along the ground interface can be visualized locally as a planar wave impinging on the boundary at a specific incidence angle defined by geometry (source height and lateral distance). Locally the signal is reflected and refracted according to Snell's law.



PICTURE SHOWING THE POSITIONING OF THE SOURCE

a) Source is located above the ground. B) source is located on the ground

Propagation of the EM wave:

SNELL'S LAW:

The direction of travel depends upon the SNELL'S LAW .

$$\frac{\sin \theta_1}{v_1} = \frac{\sin \theta_2}{v_2}$$

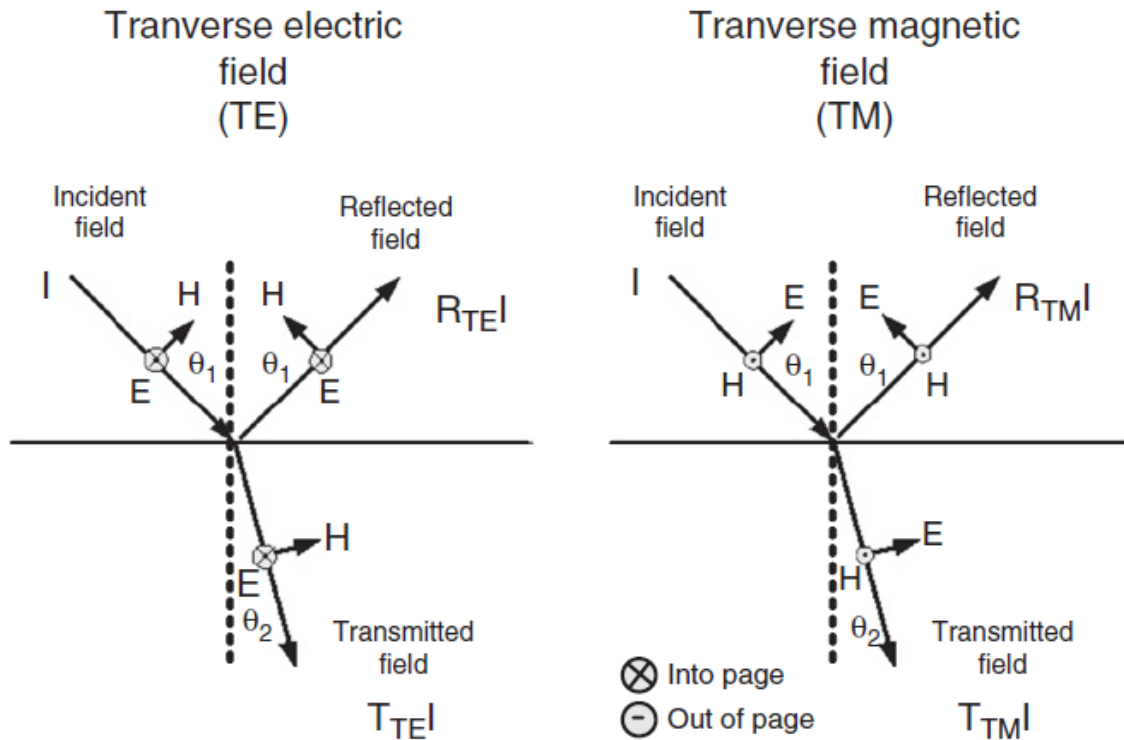
Ground penetrating radar methods normally depend on detection of reflected or scattered signal. The incident, reflected, and transmitted field strengths are related by the following equation:

$$I + R \cdot I = T \cdot I$$

Where I: strength of incident wave.

R: strength of reflected wave.

T: strength of transmitted wave.



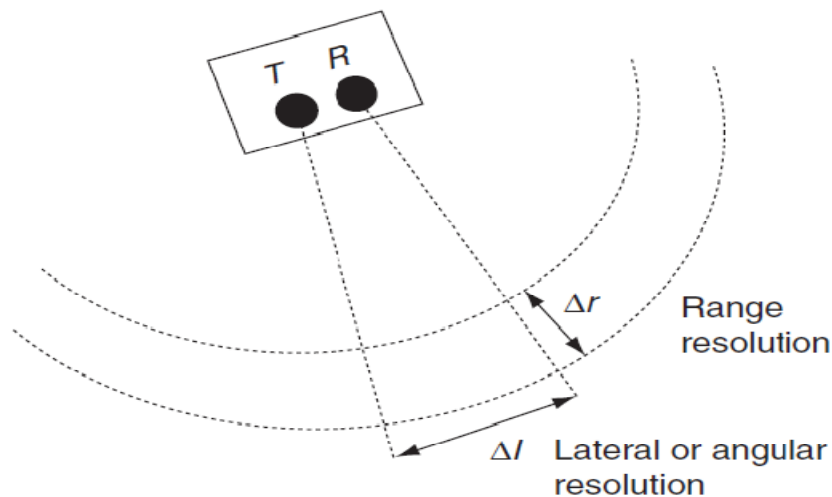
PICTURE SHOWING THE MODE OF PROPAGATION OF THE EM WAVE

Resolution and zone of influence:

Given that GPR detects objects at a distance, how accurately can the object be located and what degree of information can be extracted about the geometry of the object? Resolution indicates the limit of certainty in determining the position and the geometrical attributes of a target (such as the size, shape, and thickness) and is controlled by the observation process.

GPR resolution consists of two components. they are

1. Lateral resolution length.
2. Longitudinal resolution length.



PICTURE SHOWING THE PHENOMENA OF RESOLUTION

The radial or longitudinal resolution length is given by:

$$\Delta r \geq \frac{Wv}{4}$$

The lateral resolution length is given by:

$$\Delta l \geq \sqrt{\frac{vrW}{2}}$$

Scattering of the waves:

Ground penetrating radar signals are invariably transmitted through complicated media. The signals encounter heterogeneous electrical and magnetic properties on many scales. Smaller-scale heterogeneities generate weak or undetectable responses but their presence has an impact on the signals as they pass by. The heterogeneities extract energy as the EM field passes and scatter it in all directions.

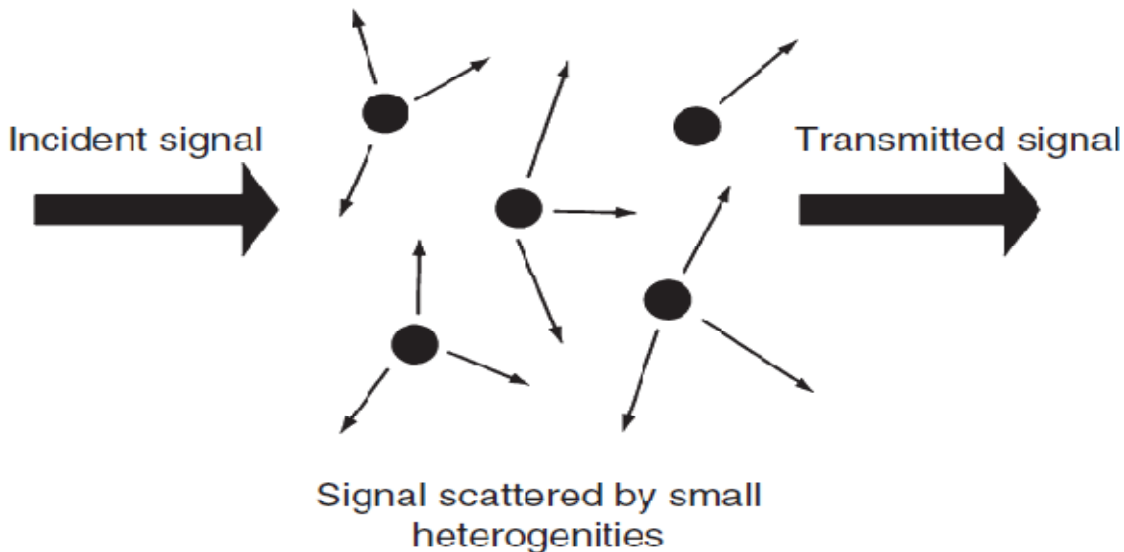
We can say that the Electric field decreases with distance 'r' as:

$$E = E_0 e^{-\alpha_s r}$$

$$\alpha_s = \frac{NA}{2}$$

Where

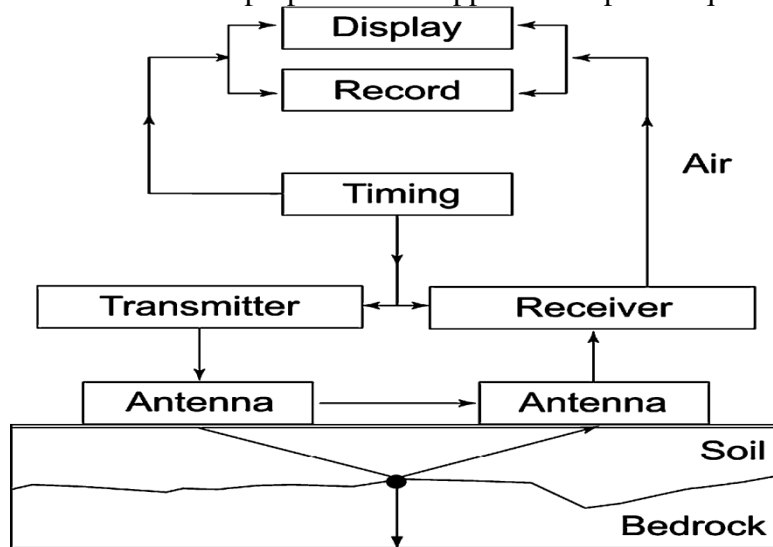
And A is the scattering cross section of the scatters.



PICTURE SHOWING THE PHENOMENA OF SCATTERING IN DEEPER LAYERS.

Data analysis:

Transforming GPR data into application-specific information can follow two paths. The first is common to all geophysical methods, namely the GPR response measured is presented in a section, plan, or volume form to indicate anomalous target location. The second is to extract quantifiable wave property variables such as velocity, attenuation, or impedance and then translate the wave properties into application-specific quantities.



BLOCK DIAGRAM SHOWING THE DATA ANALYSIS IN A GPR UNIT.

Applications of GPR in CIVIL ENGINEERING:

On roads:

1. New road alignment.
2. Site investigations.
3. Strengthening of roads
4. Widening of roads.
5. Using existing road as information for design of new roadway.

On bridges:

1. Foundation related problems.
2. Bridge decks and beams survey.
3. Other surveys such as approaching slabs.

On railways:

1. To determine ballast thickness.
2. To determine ballast quantity.
3. Sub grade surveys.
4. Site investigations.

There are still many applications where the system of NDT using GPR can be employed to obtain healthy results such as:

- Determining thickness and structures of glaciers.
- Archaeological investigations.
- Profiling the bottom of lakes and seas.
- Examining the subsurface of moon.
- Measuring scouring around bridge foundations.

Conclusion:

Rapid technology development is an essential part of our work for quality assurance. Hence to obtain better and accurate results precise and highly accurate techniques are to be employed. GPR is now well accepted technique which provides better results with less amount of production. Cost optimisation is the main point of concern for any civil engineer.

Indian Satellites

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Formed in 1969, ISRO superseded the erstwhile Indian National Committee for Space Research (INCOSPAR), which was established by the efforts of independent India's first Prime Minister Pandit Jawaharlal Nehru and his close aide, and reputed scientist Dr. Vikram Sarabhai. The establishment of ISRO thus institutionalised space activities in India. It is managed by the Department of Space, which reports to the Prime Minister.

ISRO has conducted a variety of operations for both Indian and foreign clients. It has several field installations as assets, and co-operates with the international community as a part of several bilateral and multilateral agreements. As many as 41 foreign satellites have been launched by ISRO's launch vehicles, and 28 ISRO satellites have been launched by foreign launch vehicles.

India has launched 77 Indian satellites (as of 28 March 2015) of many types since its first attempt in 1975.

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
1	Aryabhata	19 April 1975	u-11 Interkosmos	Active technological experience in building and operating a satellite system.
2	Bhaskara-I	7 June 1979	C-1 Interkosmos	First experimental remote sensing satellite. Carried TV and microwave cameras.
3	Rohini Technology Payload	10 August 1979	SLV-3	Intended for measuring in-flight performance of first experimental flight of SLV-3, the first Indian launch vehicle. Did not achieve orbit.
4	Rohini RS-1	18 July 1980	SLV-3	Used for measuring in-flight performance of second experimental launch of SLV-3.
5	Rohini RS-D1	31 May 1981	SLV-3	Used for conducting some remote sensing technology studies using a landmark sensor payload. Launched by the first developmental launch of SLV-3.
6	Ariane Passenger	19 June 1981	Ariane-1 (V-3)	First experimental communication satellite. Provided experience in building and operating a payload experiment

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
	Payload Experiment			three-axis stabilised communication satellite.
7	Bhaskara -II	20 November 1981	C-1 Intercosmos	Second experimental remote sensing satellite; similar to Bhaskara-1. Provided experience in building and operating a remote sensing satellite system on an end-to-end basis.
8	INSAT-1A	10 April 1982	Delta 3910 PAM-D	First operational multipurpose communication and meteorology satellite. Procured from USA. Worked for only six months.
9	Rohini RS-D2	17 April 1983	SLV-3	Identical to RS-D1. Launched by the second developmental launch of SLV-3.
10	INSAT-1B	30 August 1983	Shuttle [PAM-D]	Identical to INSAT-1A. Served for more than design life of seven years.
11	Stretched Rohini Satellite Series(SROSS-1)	24 March 1987	ASLV	Carried payload for launch vehicle performance monitoring and for gamma ray astronomy. Did not achieve orbit.
12	IRS-1A	17 March 1988	Vostok	Earth observation satellite. First operational remote sensing satellite.
13	Stretched Rohini Satellite Series(SROSS-2)	13 July 1988	ASLV	Carried remote sensing payload of German space agency in addition to Gamma Ray astronomy payload. Did not achieve orbit.
14	INSAT-1C	21 July 1988	Ariane-3	Same as INSAT-1A. Served for only one-and-a-half years.
15	INSAT-1D	12 June 1990	Delta 4925	Identical to INSAT-1A. Still in service. A third stage motor landed from its launch, landed in Australia in 2008. ^[2]
16	IRS-1B	29 August 1991	Vostok	Earth observation satellite. Improved version of IRS-1A.
17	INSAT-2DT	26 February 1992	Ariane-44L H10	Launched as Arabsat 1C. Procured in orbit from Arabsat in January 1998.
18	Stretched Rohini Satellite Series(SROSS-	20 May 1992	ASLV	Carried gamma ray astronomy and aeronomy payload.

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
	C)			
19	INSAT-2A	10 July 1992	Ariane-44L H10	First satellite in the second-generation Indian-built INSAT-2 series. Has enhanced capability over INSAT-1 series. Still in service.
20	INSAT-2B	23 July 1993	Ariane-44L H10+	Second satellite in INSAT-2 series. Identical to INSAT-2A. Still in service.
21	IRS-1E	20 September 1993	PSLV-D1	Earth observation satellite. Did not achieve orbit.
22	Stretched Rohini Satellite Series(SROSS-C2)	4 May 1994	ASLV	Identical to SROSS-C. Still in service.
23	IRS-P2	15 October 1994	PSLV-D2	Earth observation satellite. Launched by second developmental flight of PSLV.Mission accomplished after 3 years of service in 1997.
24	INSAT-2C	7 December 1995	Ariane-44L H10-3	Has additional capabilities such as mobile satellite service, business communication and television outreach beyond Indian boundaries. Still in service.
25	IRS-1C	29 December 1995	Molniya	Earth observation satellite. Launched from BaikonurCosmodrome.
26	IRS-P3	21 March 1996	PSLV-D3	Earth observation satellite. Carries remote sensing payload and an X-ray astronomy payload. Launched by third developmental flight of PSLV.
27	INSAT-2D	4 June 1997	Ariane-44L H10-3	Same as INSAT-2C. Inoperable since 1997-10-04 due to power bus anomaly.
28	IRS-1D	29 September 1997	PSLV-C1	Earth observation satellite. Same as IRS-1C.
29	INSAT-2E	3 April 1999	Ariane-42P H10-3	Multipurpose communication and meteorological satellite.
30	Oceansat-	26 May 1999	PSLV-C2	Earth observation satellite. Carries an Ocean Colour

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
	1 (IRS-P4)			Monitor (OCM) and a Multifrequency Scanning Microwave Radiometer (MSMR).
31	INSAT-3B	22 March 2000	Ariane-5G	Multipurpose communication: business communication, developmental communication, and mobile communication.
32	GSAT-1	18 April 2001	GSLV-D1	Experimental satellite for the first developmental flight of Geosynchronous Satellite Launch Vehicle, GSLV-D1.
33	Technology Experiment Satellite (TES)	22 October 2001	PSLV-C3	Experimental satellite to test technologies such as attitude and orbit control system, high-torque reaction wheels, new reaction control system, etc.
34	INSAT-3C	24 January 2002	Ariane-42L H10-3	Designed to augment the existing INSAT capacity for communication and broadcasting and provide continuity of the services of INSAT-2C.
35	Kalpana-1(METSAT)	12 September 2002	PSLV-C4	First meteorological satellite built by ISRO. Originally named METSAT. Renamed after KalpanaChawla who perished in the Space Shuttle Columbia.
36	INSAT-3A	10 April 2003	Ariane-5G	Multipurpose satellite for communication, broadcasting, and meteorological services along with INSAT-2E and Kalpana-1.
37	GSAT-2	8 May 2003	GSLV-D2	Experimental satellite for the second developmental test flight of Geosynchronous Satellite Launch Vehicle (GSLV)
38	INSAT-3E	28 September 2003	Ariane-5G	Communication satellite to augment the existing INSAT System.
39	RESOURCESAT-1 (IRS-P6)	17 October 2003	PSLV-C5	Earth observation/remote sensing satellite. Intended to supplement and replace IRS-1C and IRS-1D.
40	EDUSAT	20 October 2004	GSLV-F01	Also designated GSAT-3. India's first exclusive educational satellite.
41	HAMSAT	5 May 2005	PSLV-C6	Microsatellite (42.5 kilograms) for providing satellite-based amateur radio services to the national as well as the international community.
42	CARTOSAT-1	5 May 2005	PSLV-C6	Earth observation satellite. Provides stereographic in-orbit images with a 2.5-meter resolution.

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
43	INSAT-4A	22 December 2005	Ariane-5GS	Advanced satellite for direct-to-home television broadcasting services.
44	INSAT-4C	10 July 2006	GSLV-F02	Geosynchronous communications satellite. Did not achieve orbit.
45	CARTOSAT-2	10 January 2007	PSLV-C7	Advanced remote sensing satellite carrying a panchromatic camera capable of providing scene-specific spot images.
46	Space Capsule Recovery Experiment(SR E-1)	10 January 2007	PSLV-C7	Experimental satellite intended to demonstrate the technology of an orbiting platform for performing experiments in microgravity conditions. Launched as a co-passenger with CARTOSAT-2. SRE-1 was de-orbited and recovered successfully after 12 days over Bay of Bengal.
47	INSAT-4B	12 March 2007	Ariane-5ECA	Identical to INSAT-4A. Further augments the INSAT capacity for direct-to-home (DTH) television services and other communications. On the night of 7 July INSAT-4B experienced a power supply glitch which led to switching 'off' of 50 per cent of the transponder capacity (6 Ku and 6 C-Band transponders).
48	INSAT-4CR	2 September 2007	GSLV-F04	Identical to INSAT-4C. It carried 12 high-power Ku-band transponders designed to provide direct-to-home (DTH) television services, Digital Satellite News Gathering etc.
49	CARTOSAT-2A	28 April 2008	PSLV-C9	Earth observation/remote sensing satellite. Identical to CARTOSAT-2.
50	IMS-1 (Third World Satellite – TWsat)	28 April 2008	PSLV-C9	Low-cost microsatellite imaging mission. Launched as co-passenger with CARTOSAT-2A.
51	Chandrayaan-1	22 October 2008	PSLV-C11	Unmanned lunar probe. Carries 11 scientific instruments built in India, USA, UK, Germany, Sweden and Bulgaria.
52	RISAT-2	20 April 2009	PSLV-C12	Radar imaging satellite used to monitor India's borders and as part of anti-infiltration and anti-terrorist operations. Launched as a co-passenger with ANUSAT.

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
53	ANUSAT	20 April 2009	PSLV-C12	Research microsatellite designed at Anna University. Carries an amateur radio and technology demonstration experiments.
54	Oceansat-2 (IRS-P4)	23 September 2009	PSLV-C14	Gathers data for oceanographic, coastal and atmospheric applications. Continues mission of Oceansat-1.
55	GSAT-4	15 April 2010	GSLV-D3	Communications satellite technology demonstrator. Failed to reach orbit due to GSLV-D3 failure.
56	CARTOSAT-2B	12 July 2010	PSLV-C15	Earth observation/remote sensing satellite. Identical to CARTOSAT-2A.
57	StudSat	12 July 2010	PSLV-C15	First Indian pico-satellite (weighing less than 1 kg). Developed by a team from seven engineering colleges from Karnataka and Andhra Pradesh.
58	GSAT-5P /INSAT-4D	25 December 2010	GSLV-F06	C-band communication satellite, failed to reach orbit due to GSLV-F06 failure.
59	RESOURCESAT-2	20 April 2011	PSLV-C16	RESOURCESAT-2, ISRO's eighteenth remote-sensing satellite, followed RESOURCESAT-1. PSLV-C16 placed three spacecraft with a total payload mass of 1404 kg – RESOURCESAT-2 weighing 1206 kg, the Indo-Russian YOUTHSAT weighing 92 kg and Singapore's X-SAT weighing 106 kg – into an 822 km polar Sun Synchronous Orbit (SSO).
60	Youthsat	20 April 2011	PSLV-C16	Indo-Russian stellar and atmospheric satellite with the participation of university students. It weighed 92 kg
61	GSAT-8 / INSAT-4G	21 May 2011	Ariane-5VA-202	Communications satellite carries 24 Ku-band transponders and 2 channel GAGAN payload operating in L1 and L5 band.
62	GSAT-12	15 July 2011	PSLV-C17	GSAT-12 communication satellite built by ISRO, weighs about 1410 kg at lift-off. GSAT-12 is configured to carry 12 Extended C-band transponders to meet the country's growing demand for transponders in a short turn-around-time. The 12 Extended C-band transponders of GSAT-12 will augment the capacity in the INSAT system for various communication services like Tele-education, Telemedicine and for Village Resource Centres

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
				(VRC).Mission life About 8 Years.
63	Megha-Tropiques	12 October 2011	PSLV-C18	Megha-Tropiques weighs about 1000 kg Lift-off Mass, developed jointly by ISRO and the French Centre National d'Études Spatiales (CNES). PSLV-C18 is configured to carry four satellites in which, one satellite, developed by India and France, will track the weather, two were developed by educational institutions, and the fourth is from Luxembourg.
64	Jugnu	12 October 2011	PSLV-C18	Nano-satellite weighing 3 kg developed by IIT Kanpur
65	RISAT-1	26 April 2012	PSLV-C19	RISAT-1, first indigenous all-weather Radar Imaging Satellite (RISAT-1), whose images will facilitate agriculture and disaster management weighs about 1858 kg.
66	SRMSAT	26 April 2012	PSLV-C18	Nano-satellite weighing 10.9 kg developed by SRM University.
67	GSAT-10	29 September 2012	Ariane-5VA-209	GSAT-10, India's advanced communication satellite, is a high power satellite being inducted into the INSAT system. Weighing 3400 kg at lift-off.
68	SARAL	25 February 2013	PSLV-C20	SARAL, The Satellite with ARGOS and ALTIKA (SARAL) is a joint Indo-French satellite mission for oceanographic studies.
69	IRNSS-1A	1 July 2013	PSLV-C22	IRNSS-1A is the first satellite in the Indian Regional Navigation Satellite System (IRNSS). It is one of the seven spacecraft constituting the IRNSS space segment.
70	INSAT-3D	26 July 2013	Ariane-5	INSAT-3D is the meteorological Satellite with advanced weather monitoring payloads.
71	GSAT-7	30 August 2013	Ariane-5	GSAT-7 is the advanced multi-band communication satellite dedicated for military use.
72	Mars Orbiter Mission (MOM)	5 November 2013	PSLV-C25	The Mars Orbiter Mission (MOM), informally called Mangalyaan is India's first Mars orbiter.
73	GSAT-14	5 January	GSLV-D5	GSAT-14 is the twenty third geostationary communication

Sl. No.	Satellite	Launch Date	Launch Vehicle	Remarks
		2014		satellite of India to augment the In-orbit capacity of Extended C and Ku-band transponders.
74	IRNSS-1B	4 April 2014	PSLV-C24	IRNSS-1B is the second satellite in the Indian Regional Navigation Satellite System (IRNSS).
75	IRNSS-1C	10 November 2014	PSLV-C26	IRNSS-1C is the third satellite in the Indian Regional Navigation Satellite System (IRNSS).
76	GSAT-16	7 December 2014	Ariane-5	GSAT-16 is twenty fourth communication satellite of India configured to carry a total of 48 communication transponders.
77	IRNSS-1D	28 March 2015	PSLV-C27	IRNSS-1D is the fourth satellite in the Indian Regional Navigation Satellite System (IRNSS).

Magnetic refrigeration

By

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Magnetic refrigeration is a cooling technology based on the **magnetocaloric effect**. This technique can be used to attain extremely low temperatures, as well as the ranges used in common refrigerators. Compared to traditional gas-compression refrigeration, magnetic refrigeration is safer and more environmentally friendly because it does not use harmful, ozone-depleting coolant gases, quieter, more compact, and has a higher cooling efficiency.

The effect was first observed by French physicist P. Weiss and Swiss physicist A. Piccard in 1917. The fundamental principle was suggested by P. Debye (1926) and W. Giauque (1927). The first working magnetic refrigerators were constructed by several groups beginning in 1933. Magnetic refrigeration was the first method developed for cooling below about 0.3K (a temperature attainable by 3He refrigeration, that is pumping on the 3He vapors).

The magneto caloric effect

The magneto caloric effect (MCE, from *magnet* and *calorie*) is a magneto-thermodynamic phenomenon in which a temperature change of a suitable material is caused by exposing the material to a changing magnetic field. This is also known by low temperature physicists as *adiabatic demagnetization*. In that part of the refrigeration process, a decrease in the strength of an externally applied magnetic field allows the magnetic domains of a magnetocaloric material to become disoriented from the magnetic field by the agitating action of the thermal energy (phonons) present in the material. If the material is isolated so that no energy is allowed to (re)migrate into the material during this time, (i.e., an adiabatic process) the temperature drops as the domains absorb the thermal energy to perform their reorientation. The randomization of the domains occurs in a similar fashion to the randomization at the curie temperature of a ferromagnetic material, except that magnetic dipoles overcome a decreasing external magnetic field while energy remains constant, instead of magnetic domains being disrupted from internal ferromagnetism as energy is added.

One of the most notable examples of the magnetocaloric effect is in the chemical element gadolinium and some of its alloys. Gadolinium's temperature increases when it enters certain magnetic fields. When it leaves the magnetic field, the temperature drops. The effect is considerably stronger for the gadolinium alloy (Gd₅Si₂Ge₂) Praseodymium alloyed with nickel (PrNi₅) has such a strong magnetocaloric effect that it has allowed scientists to approach to within one milliKelvin, one thousandth of a degree of absolute zero.

Equation

The magnetocaloric effect can be quantified with the equation below:

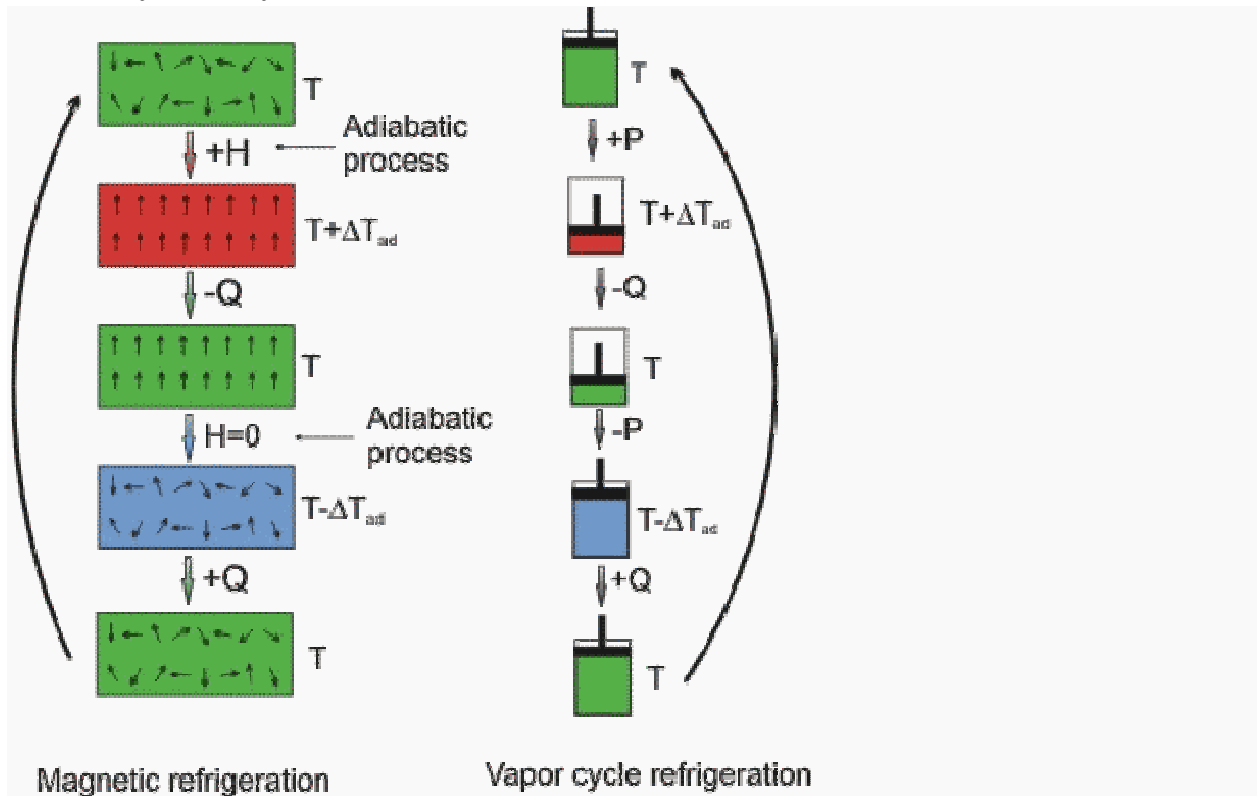
$$\Delta T_{ad} = - \int_{H_0}^{H_1} \left(\frac{T}{C(T, H)} \right)_H \left(\frac{\partial M(T, H)}{\partial T} \right)_H dH$$

where T is the temperature, H is the applied magnetic field, C is the heat capacity of the working magnet (refrigerant) and M is the magnetization of the refrigerant.

From the equation we can see that magnetocaloric effect can be enhanced by:

- applying a large field
- using a magnet with a small heat capacity
- using a magnet with a large change in magnetization vs. temperature, at a constant magnetic field

Thermodynamic cycle



Analogy between magnetic refrigeration and vapor cycle or conventional refrigeration. H = externally applied magnetic field; Q = heat quantity; P = pressure; ΔT_{ad} = adiabatic temperature variation

The cycle is performed as a refrigeration cycle that is analogous to the Carnot refrigeration cycle, but with increases and decreases in magnetic field strength instead of increases and decreases in pressure. It can be described as a starting point whereby the chosen working substance is introduced into a magnetic field, i.e., the magnetic flux density is increased. The working material is the refrigerant, and starts in thermal equilibrium with the refrigerated environment.

- *Adiabatic magnetization:* A magnetocaloric substance is placed in an insulated environment. The increasing external magnetic field ($+H$) causes the magnetic dipoles of the atoms to align, thereby decreasing the material's magnetic entropy and heat capacity. Since overall energy is not lost (yet) and therefore total entropy is not reduced (according to thermodynamic laws), the net result is that the substance is heated ($T + \Delta T_{ad}$).

- *Isomagnetic enthalpic transfer:* This added heat can then be removed ($-Q$) by a fluid or gas — gaseous or liquid helium, for example. The magnetic field is held constant to prevent the dipoles from reabsorbing the heat. Once sufficiently cooled, the magnetocaloric substance and the coolant are separated ($H=0$).
- *Adiabatic demagnetization:* The substance is returned to another adiabatic (insulated) condition so the total entropy remains constant. However, this time the magnetic field is decreased, the thermal energy causes the magnetic moments to overcome the field, and thus the sample cools, i.e., an adiabatic temperature change. Energy (and entropy) transfers from thermal entropy to magnetic entropy (disorder of the magnetic dipoles).
- *Isomagnetic entropic transfer:* The magnetic field is held constant to prevent the material from reheating. The material is placed in thermal contact with the environment to be refrigerated. Because the working material is cooler than the refrigerated environment (by design), heat energy migrates into the working material ($+Q$).

Once the refrigerant and refrigerated environment are in thermal equilibrium, the cycle can restart.

Applied technique

The basic operating principle of an adiabatic demagnetization refrigerator (ADR) is the use of a strong magnetic field to control the entropy of a sample of material, often called the "refrigerant". Magnetic field constrains the orientation of magnetic dipoles in the refrigerant. The stronger the magnetic field, the more aligned the dipoles are, corresponding to lower entropy and heat capacity because the material has (effectively) lost some of its internal degrees of freedom. If the refrigerant is kept at a constant temperature through thermal contact with a heat sink (usually liquid helium) while the magnetic field is switched on, the refrigerant must lose some energy because it is equilibrated with the heat sink. When the magnetic field is subsequently switched off, the heat capacity of the refrigerant rises again because the degrees of freedom associated with orientation of the dipoles are once again liberated, pulling their share of equipartitioned energy from the motion of the molecules, thereby lowering the overall temperature of a system with decreased energy. Since the system is now insulated when the magnetic field is switched off, the process is adiabatic, i.e., the system can no longer exchange energy with its surroundings (the heat sink), and its temperature decreases below its initial value, that of the heat sink.

The operation of a standard ADR proceeds roughly as follows. First, a strong magnetic field is applied to the refrigerant, forcing its various magnetic dipoles to align and putting these degrees of freedom of the refrigerant into a state of lowered entropy. The heat sink then absorbs the heat released by the refrigerant due to its loss of entropy. Thermal contact with the heat sink is then broken so that the system is insulated, and the magnetic field is switched off, increasing the heat capacity of the refrigerant, thus decreasing its temperature below the temperature of the heat sink. In practice, the magnetic field is decreased slowly in order to provide continuous cooling and keep the sample at an approximately constant low temperature. Once the field falls to zero or

to some low limiting value determined by the properties of the refrigerant, the cooling power of the ADR vanishes, and heat leaks will cause the refrigerant to warm up.

Working materials

The magnetocaloric effect (MCE) is an intrinsic property of a magnetic solid. This thermal response of a solid to the application or removal of magnetic fields is maximized when the solid is near its magnetic ordering temperature. Thus, the materials considered for magnetic refrigeration devices should be magnetic materials with a magnetic phase transition temperature near the temperature region of interest. For refrigerators that could be used in the home, this temperature is room temperature. The temperature change can be further increased when the order-parameter of the phase transition changes strongly within the temperature range of interest. The magnitudes of the magnetic entropy and the adiabatic temperature changes are strongly dependent upon the magnetic ordering process. The magnitude is generally small in antiferromagnets, ferrimagnets and spin glass systems but can be much larger for ferromagnets that undergo a magnetic phase transition. First order phase transitions are characterized by a discontinuity in the magnetization changes with temperature, resulting in a latent heat. Second order phase transitions do not have this latent heat associated with the phase transition.

In the late 1990s Pecharsky and Gschneidner reported a magnetic entropy change in $\text{Gd}_5(\text{Si}_2\text{Ge}_2)$ that was about 50% larger than that reported for Gd metal, which had the largest known magnetic entropy change at the time. This giant magnetocaloric effect (GMCE) occurred at 270K, which is lower than that of Gd (294K). Since the MCE occurs below room temperature these materials would not be suitable for refrigerators operating at room temperature. Since then other alloys have also demonstrated the giant magnetocaloric effect. Include $\text{Gd}_5(\text{Si}_x\text{Ge}_{1-x})_4$, $\text{La}(\text{Fe}_x\text{Si}_{1-x})_{13}\text{H}_x$ and $\text{MnFeP}_{1-x}\text{As}_x$ alloys, Gadolinium and its alloys undergo second-order phase transitions that have no magnetic or thermal hysteresis. However, the use of rare earth elements makes these materials very expensive.

Ni

2Mn-X ($\text{X} = \text{Ga}, \text{Co}, \text{In}, \text{Al}, \text{Sb}$) Heusler alloys are also promising candidates for magnetic cooling applications because they have Curie temperatures near room temperature and, depending on composition, can have martensitic phase transformations near room temperature. These materials exhibit the magnetic shape memory effect and can also be used as actuators, energy harvesting devices, and sensors. When the martensitic transformation temperature and the Curie temperature are the same (based on composition) the magnitude of the magnetic entropy change is the largest. In February 2014, GE announced the development of a functional Ni-Mn-based magnetic refrigerator.

The development of this technology is very material-dependent and will likely not replace vapor-compression refrigeration without significantly improved materials that are cheap, abundant, and exhibit much larger magnetocaloric effects over a larger range of temperatures. Such materials need to show significant temperature changes under a field of two tesla or less, so that permanent magnets can be used for the production of the magnetic field.

Paramagnetic salts

The original proposed refrigerant was a paramagnetic salt, such as cerium magnesium nitrate. The active magnetic dipoles in this case are those of the electron shells of the paramagnetic atoms.

In a paramagnetic salt ADR, the heat sink is usually provided by a pumped ^4He (about 1.2 K) or ^3He (about 0.3 K) cryostat. An easily attainable 1 T magnetic field is generally required for initial magnetization. The minimum temperature attainable is determined by the self-magnetization tendencies of the refrigerant salt, but temperatures from 1 to 100 mK are accessible. Dilution refrigerators had for many years supplanted paramagnetic salt ADRs, but interest in space-based and simple to use lab-ADRs has remained, due to the complexity and unreliability of the dilution refrigerator

Eventually paramagnetic salts become either diamagnetic or ferromagnetic, limiting the lowest temperature that can be reached using this method.

Nuclear demagnetization

One variant of adiabatic demagnetization that continues to find substantial research application is nuclear demagnetization refrigeration (NDR). NDR follows the same principles, but in this case the cooling power arises from the magnetic dipoles of the nuclei of the refrigerant atoms, rather than their electron configurations. Since these dipoles are of much smaller magnitude, they are less prone to self-alignment and have lower intrinsic minimum fields. This allows NDR to cool the nuclear spin system to very low temperatures, often 1 μK or below. Unfortunately, the small magnitudes of nuclear magnetic dipoles also make them less inclined to align to external fields. Magnetic fields of 3 teslas or greater are often needed for the initial magnetization step of NDR. In NDR systems, the initial heat sink must sit at very low temperatures (10–100 mK). This precooling is often provided by the mixing chamber of a dilution refrigerator or a paramagnetic salt.

Commercial development

Research and a demonstration proof of concept in 2001 succeeded in applying commercial-grade materials and permanent magnets at room temperatures to construct a magnetocaloric refrigerator.

On August 20, 2007, the Risø National Laboratory (Denmark) at the Technical University of Denmark, claimed to have reached a milestone in their magnetic cooling research when they reported a temperature span of 8.7 K. They hope to introduce the first commercial applications of the technology by 2010.

As of 2013 this technology had proven commercially viable only for ultra-low temperature cryogenic applications available for decades. Magnetocaloric refrigeration systems are composed of pumps, motors, secondary fluids, heat exchangers of different types, magnets and magnetic materials. These processes are greatly affected by irreversibilities and should be adequately considered. At year-end, Cooltech Applications announced that its first commercial refrigeration equipment would enter the market in 2014. At the 2015 Consumer Electronics Show in Las Vegas, a consortium of Haier, Astronautics Corporation of America and BASF presented the first cooling appliance.

Current and future uses

Thermal and magnetic hysteresis problems remain to be solved for first-order phase transition materials that exhibit the GMCE.

One potential application is in spacecraft.

Vapor-compression refrigeration units typically achieve performance coefficients of 60% of that of a theoretical ideal Carnot cycle, much higher than current MR technology. Small domestic refrigerators are however much less efficient.

In 2014 giant anisotropic behaviour of the magnetocaloric effect was found in HoMn_2O_5 at 10 K. The anisotropy of the magnetic entropy change gives rise to a large rotating MCE offering the possibility to build simplified, compact, and efficient magnetic cooling systems by rotating it in a constant magnetic field.

History

The effect was discovered using nickel in 1917 by French physicist Pierre Weiss and Auguste Piccard. Originally, the cooling effect was less than 0.5 K/T.

Major advances first appeared in the late 1920s when cooling via adiabatic demagnetization was independently proposed by Peter Debye in 1926 and chemistry Nobel Laureate William F. Giauque in 1927.

It was first demonstrated experimentally by Giauque and his colleague D. P. MacDougall in 1933 for cryogenic purposes when they reached 0.25 K. Between 1933 and 1997, advances in MCE cooling occurred.

In 1997, the first near room-temperature proof of concept magnetic refrigerator was demonstrated by Karl A. Gschneidner, Jr. by the Iowa State University at Ames Laboratory. This event attracted interest from scientists and companies worldwide who started developing new kinds of room temperature materials and magnetic refrigerator designs.

A major breakthrough came 2002 when a group at the University of Amsterdam demonstrated the giant magnetocaloric effect in $\text{MnFe}(\text{P}, \text{As})$ alloys that are based on abundant materials.

Refrigerators based on the magnetocaloric effect have been demonstrated in laboratories, using magnetic fields starting at 0.6 T up to 10 T. Magnetic fields above 2 T are difficult to produce with permanent magnets and are produced by a superconducting magnet (1 T is about 20,000 times the Earth's magnetic field).

Room temperature devices

Recent research has focused on near room temperature. Constructed examples of room temperature magnetic refrigerators include:

Computer Forensics: Open Source Tools

K. V. RamHarsha, III-CSE

Introduction: Computer forensics is a very important branch of computer science in relation to computer and Internet related crimes. Earlier, computers were only used to produce data but now it has expanded to all devices related to digital data. The goal of Computer forensics is to perform crime investigations by using evidence from digital data to find who was the responsible for that particular crime. ComputerForensics (CF) has grown from a relatively obscure tradecraft to an important part of many investigations. CF tools are now used on a daily basis by examiners and analysts within local, state and Federal law enforcement; within the military and other government organizations; and within the private “e-Discovery” industry. Developments in forensic research, tools, and process over the past decade have been very successful and many in leadership positions now rely on these tools on a regular basis frequently without realizing it. Moreover, there seems to be a widespread belief, buttressed on by portrayals in the popular media, that advanced tools and skillful practitioners can extract actionable information from practically any device that a government, private agency, or even a skillful individual might encounter.

For better research and investigation, developers have created many computer forensics tools. Police departments and investigation agencies select the tools based on various factors including budget and available experts on the team. These computer forensics tools can also be classified into various categories:

- Disk and data capture tools
- File viewers
- File analysis tools
- Registry analysis tools
- Internet analysis tools
- Email analysis tools
- Mobile devices analysis tools
- Mac OS analysis tools
- Network forensics tools
- Database forensics tools

This article focuses on Computer forensics history and the open software tools used in Computer forensic investigation.

II. History:

ComputerForensics is roughly forty years old. What we now consider forensic techniques were developed primarily for data recovery. For example, Wood et al. relate a story about two local data recovery experts working for 70th to recover the only copy of a highly fragmented database

file inadvertently erased by a careless researcher . By the late 1980s utilities were being widely advertised that could perform a variety of data recovering, including “Unformat, Undelete Diagnose& Remedy”

Forensics became so widespread and reliable that it escaped from the lab and onto the TV screen, creating the so-called “CSI Effect.” This Golden Age was characterized by:

- The widespread use of Microsoft Windows, and specifically Windows XP.
- Relatively few file formats of forensic interest mostly Microsoft Office for documents, JPEG for digital photographs; and AVI and WMV for video.
- Examinations largely confined to a single computer system belonging to the subject of the investigation. Storage devices equipped with standard interfaces (IDE/ ATA), attached using removable cables and connectors, and secured with removable screws.
- Multiple vendors selling tools that were reasonably good at recovering allocated and deleted files.

The widespread dominance of the so-called “WinTel” platform meant that many digital forensics examiners could be successful knowing that system and no others. The widespread failure of the market to adopt encryption technology for data-at-rest (Garfinkel and Shalat, 2002) made it relatively easy to develop and sell forensic tools that were actually useful to a wide range of customers. These tools allowed someone with relatively limited training to search for email messages, recover deleted files and perform basic file carving.

III. Computer forensics crisis:

Today much of the last decade’s progress is quickly becoming irrelevant. Computer Forensics is facing a crisis. Hard-won capabilities are in jeopardy of being diminished or even lost as the result of advances and fundamental changes in the computer industry:

- The growing size of storage devices means that there is frequently insufficient time to create a forensic image of a subject device, or to process all of the data once it is found.
- The proliferation of operating systems and file formats is dramatically increasing the requirements and complexity of data exploitation tools and the cost of tool development.
- Whereas cases were previously limited to the analysis of a single device, increasingly cases require the analysis of multiple devices followed by the correlation of the found evidence.
- Pervasive encryption means that even when data can be recovered, it frequently cannot be processed.
- Use of the “cloud” for remote processing and storage, and to split a single data structure into elements, means that frequently data or code cannot even be found.
- Malware that is not written to persistent storage necessitates the need for expensive RAM forensics.
- Legal challenges increasingly limit the scope of forensic investigations.

Today’s examiners frequently cannot obtain data in a forensically sound manner or process that data to completion once they obtain it. Evidence, especially exculpatory evidence, may be routinely missed.

IV Computer Forensics Tools: This section concentrates on open source tools which are used in computer forensics investigation process. There are 10 of the best free tools that will help you conduct a digital forensic investigation. Whether it’s for an internal human resources case, an investigation into unauthorized access to a server, or if you just want to learn a new skill, these

suites and utilities will help you conduct memory forensic analysis, hard drive forensic analysis, forensic image exploration, forensic imaging and mobile forensics. As such, they all provide the ability to bring back in-depth information about what's "under the hood" of a system.

01 SANS SIFT

The SANS Investigative Forensic Toolkit (SIFT) is an Ubuntu based Live CD which includes all the tools you need to conduct an in-depth forensic or incident response investigation. It supports analysis of Expert Witness Format (E01), Advanced Forensic Format (AFF), and RAW (dd) evidence formats. SIFT includes tools such as log2timeline for generating a timeline from system logs, Scalpel for data file carving, Rifiuti for examining the recycle bin, and lots more.

02 ProDiscover Basic

ProDiscover Basic is a simple digital forensic investigation tool that allows you to image, analyse and report on evidence found on a drive. Once you add a forensic image you can view the data by content or by looking at the clusters that hold the data. You can also search for data using the Search node based on the criteria you specify.

03 Volatility

Volatility is a memory forensics framework for incident response and malware analysis that allows you to extract digital artifacts from volatile memory (RAM) dumps. Using Volatility you can extract information about running processes, open network sockets and network connections, DLLs loaded for each process, cached registry hives, process IDs, and more.

04 The Sleuth Kit (+Autopsy)

The Sleuth Kit is an open source digital forensics toolkit that can be used to perform in-depth analysis of various file systems. Autopsy is essentially a GUI that sits on top of The Sleuth Kit. It comes with features like Timeline Analysis, Hash Filtering, File System Analysis and Keyword Searching out of the box, with the ability to add other modules for extended functionality.

05 FTK Imager

FTK Imager is a data preview and imaging tool that allows you to examine files and folders on local hard drives, network drives, CDs/DVDs, and review the content of forensic images or memory dumps. Using FTK Imager you can also create SHA1 or MD5 hashes of files, export files and folders from forensic images to disk, review and recover files that were deleted from the Recycle Bin (providing that their data blocks haven't been overwritten), and mount a forensic image to view its contents in Windows Explorer.

06 Linux 'dd'

dd comes by default on the majority of Linux distributions available today (e.g. Ubuntu, Fedora). This tool can be used for various digital forensic tasks such as forensically wiping a drive (zeroing out a drive) and creating a raw image of a drive.

To use dd, simply open a terminal window and type dd followed by a set of command parameters (which command parameters will obviously depend on what you want to do).

07 CAINE

CAINE (Computer Aided Investigative Environment) is Linux Live CD that contains a wealth of digital forensic tools. Features include a user-friendly GUI, semi-automated report creation and tools for Mobile Forensics, Network Forensics, Data Recovery and more.

08 Oxygen Forensic Suite 2013 Standard

If you are investigating a case that requires you to gather evidence from a mobile phone to support your case, Oxygen Forensics Suite (Standard Edition) is a tool that will help you achieve this. Features include the ability to gather Device Information (Manufacturer, OS Platform, IMEI, Serial Number, etc.), Contacts, Messages (Emails, SMS, MMS, etc.) and recovery of deleted messages, Call Logs, and Calendar and Task information. It also comes with a file browser which allows you to access and analyse user photos, videos, documents and device databases.

09 Free Hex Editor Neo

Free Hex Editor Neo is a basic hex editor that was designed to handle very large files. While a lot of the additional features are found in the commercial versions of Hex Editor Neo, I find this tool useful for loading large files (e.g. database files or forensic images) and performing actions such as manual data carving, low-level file editing, information gathering, or searching for hidden data.

10NetSleuth

NetSleuth is a network forensics analysis tool that identifies devices on your network. It operates in 'live' mode (where it will actively capture network packets and interpret device information) or in 'offline' mode where it will process a PCAP file that you import.

V.Conclusion:

Computer forensics are very important branch of computer science in relation to computer and Internet related crimes. This article discussed about the computer forensics introduction and its history. It also concentrates on result of advances and fundamental changes in the computer industry: Afterwards, 10 most preferable open source tools used in computer investigation process.

AUGMENTED REALITY

Y.Naveena

INTRODUCTION

Augmented Reality is a developing concept. It is used to visualize objects in a 3D view. It reduces the boundary between an individual's virtuality and reality and can be briefly described as an advancement of virtual reality. Augmented reality is a way of fusing the real and the virtual world by overlaying digital data onto real-world analogue views.

We can generally find Augmented Reality system to have the following properties:

- Combines real and virtual objects in a real environment
- Runs interactively, and in real time
- Aligns real and virtual objects with each other.

Augment Reality can be thought of as a “middle ground” between Virtual Environment (**completely synthetic**) & Tele-presence (**completely real**).

It can be simply explained as a view of direct or indirect physical real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data.



If we observe the above Image, it is clear that a paper sheet is there with a 2D diagrams and the person is able to view those 2D images in 3D, making it more easy for the person to understand the images. This what Augmented Reality is all about, It let us understand or view a video/image in a much better way than it is really is. Hence, “We can virtually able to see the reality”.

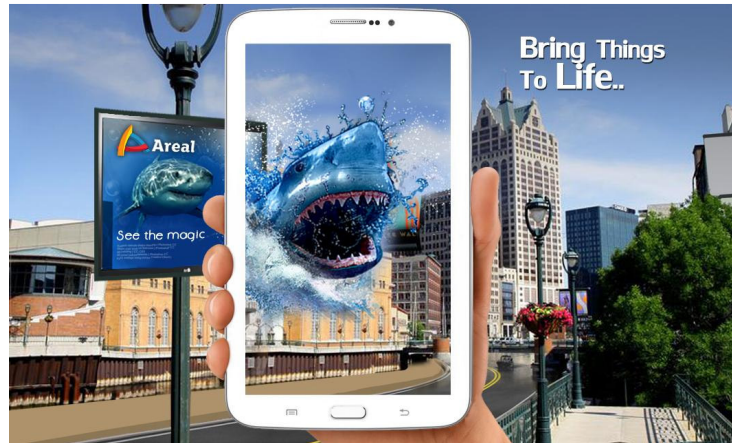
HOW DOES IT WORK

On a technical level, it is broadly classified into 2 categories

1. Marked-based system
2. Location-based system

MARKED BASED

This technology uses physical-world symbols as a reference point for computer graphics to be overlaid. For example, when a 2-dimensional printed marker is placed in front of a device which has AR features in it, the device interprets the printed marker and produces a 3D image of it as if it were directly on top of the marker in the physical world.



In the above image the Areal advertisement consists a 2D shark image with the marker in it, when the device interprets the image a 3D image is produced making it look like a real shark.

The marker has a particular pattern which will be recognized by the software of the device and produce the 3D image based upon the pattern.(symbol/barcode)

LOCATION BASED

Location-based system use the ability of a particular device to record its position in the world and then offer data that's relevant to that location. It can be finding a way around a city, remembering where you parked the car, naming the mountains around you or the stars in the sky and many other

It stores all the information around the world about all the places and by using our device Global Positioning System (GPS) it gives all the information about the place that we are currently in.



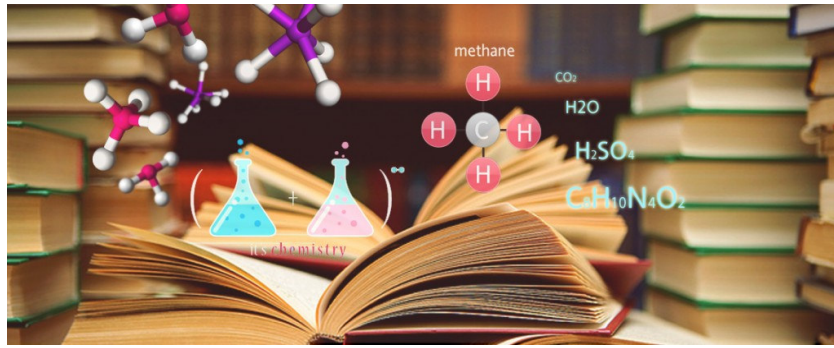
From the above image we can clearly see the all the details about the place we are in, including length of the distance between cars and the entrance to office.

APPLICATIONS

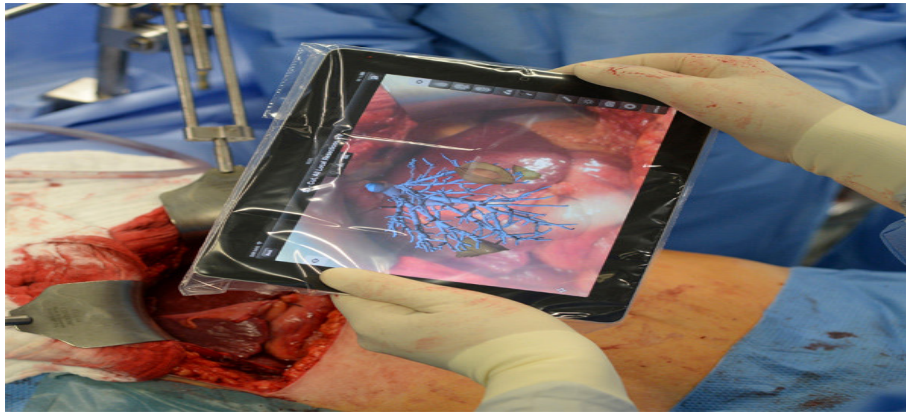
Architecture:By using augmented reality technology we can virtually experience the entire architecture of a building or any construction even before constructing it and we can also experience the inner parts of it.



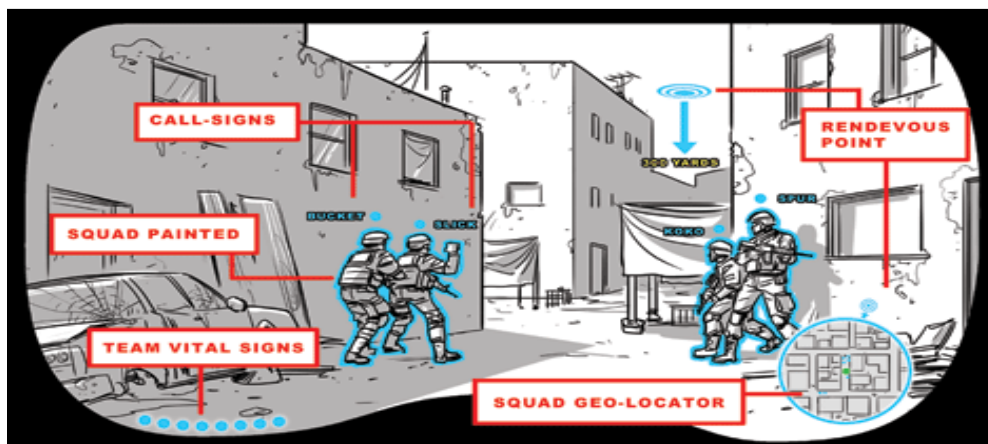
.Education and Training:By using AR educating certain concepts which needs practical outlook can be made easy and it has a many varied applications in the education sector and also for trainings in some sectors.Adding historical context to a particular place, highlighting geometric shapes and hidden angles in buildings are just a couple of examples of ways that lessons could be brought to life.



Medical: Augmented Reality can provide the surgeon with information, which are otherwise hidden, such as showing the heartbeat rate, the blood pressure, the state of the patient's organ, etc. AR can be used to let a doctor look inside a patient by combining one source of images such as an [X-ray](#) with another such as video.



Military: In military the solders can view the particular place clearly from far away and also the number of people who are there at a place and the weapons armed by the other solders making it easy for them to analyze the situation and thus taking the better decisions. Can simply tell as how a robot sees the people and objects.



Apps in Existence: Across Air, Google sky map, Augment8, Ion road augmented driving, wiktitude world browser, Augment car finder, lookator

CONCLUSION:

Augmented Reality (AR) is a growing area in virtual reality research. The world environment around us provides a wealth of information that is difficult to duplicate in a computer. This is evidenced by the worlds used in virtual environments. Either these worlds are very simplistic such as the environments created for immersive entertainment and games, or the system that can create a more realistic environment has a million dollar price tag such as flight simulators. An augmented reality system generates a composite view for the user. It is a combination of the real scene viewed by the user and a virtual scene generated by the computer that augments the scene with additional information.

In all those applications the augmented reality presented to the user enhances that person's performance in and perception of the world. The ultimate goal is to create a system such that the user can not tell the difference between the real world and the virtual augmentation of it. To the user of this ultimate system it would appear that he is looking at a single real scene

REACTIVE DISTILLATION FOR MTBE PRODUCTION

K Surya Vamsi, JNTU No: 13341A0813, III B Tech, Chemical Engineering

Abstract:

REACTIVE DISTILLATION- From the name we can say that it is both reaction and separation process used to produce a product and separate it from by-products simultaneously. Reactive distillation has many advantages such as Simplification of the separation system can lead to significant capital savings, improved conversion of reactant approaching 100%, reduced recycle costs, improved product selectivity, over-coming limitations imposed by equilibrium (reversible reaction), heat integration benefits, avoidance of hot spots and run away reactions. The major constraints of reactive distillation are Close relative volatilities of components, residence time requirements (avoid long reaction times), mismatch of process conditions (reaction and distillation), scale up and large flow rates (liquid distribution problems). In this article we are discussion about preparation of Methyl Tertiary Butyl Ether (MTBE) in a Reactive Distillation Process. MTBE is a valuable gasoline's octane number booster.

INTRODUCTION

Reactive distillation is a combination of separation and reaction in a single process. Commercial reactive distillation processes for the manufacture of methyl *t*-butyl ether (MTBE) and methyl acetate were successfully commissioned in 1981 and 1983, respectively. These processes have a distinct edge over their conventional predecessors. The reactive distillation process is particularly advantageous in the case of reversible reactions where the conversion is limited by thermodynamic equilibrium. Some of the important benefits of reactive distillation are: reduced capital cost; employment of low mole ratios of reactants; energy saving owing to utilization of the heat of reaction; and automatic temperature control and elimination of hot spots. The commercial process of MTBE manufacture has shown that heterogeneous catalysts such as ion exchange resins can be advantageously used in reactive distillation columns. Innovative techniques of confining the small size resin particles (0.3-2 mm) in the column, allowing efficient solid-liquid contact and high void fraction, have been developed. An alternative approach is to prepare a catalyst in the form of conventional column packing and pack it directly into the reactive distillation column.

MTBE PRODUCTION:

CONVENTIONAL PROCESS:

The area of particular interest where reactive distillation can be used is the production of fuel ethers such as MTBE. Gasoline reformulation using these ethers as environmentally benign octane boosters has been driven by various Clean Air Acts, which have boosted MTBE production to a new level. By 2001 the production of MTBE is expected to be 25×10^6 tons per annum worldwide. *t*-Amyl methyl ether (TAME) and ethyl *t*-butyl ether (ETBE) are also emerging as promising fuel additives. In addition to its property as an antiknock agent to enhance the octane number of the fuel, MTBE improves the water tolerance limit of the fuel and has a higher calorific value than that of other additives such as methanol.

MTBE is a product of the liquid-phase reaction of isobutylene and methanol, catalyzed by a strong acidic macro reticular ion exchange resin. The reaction is highly selective, so that methanol reacts only with isobutylene in the presence of other C₄ olefins.

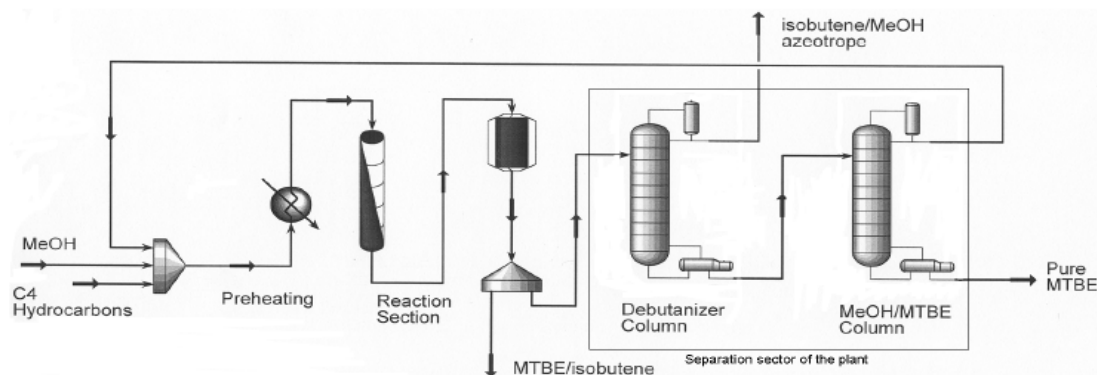
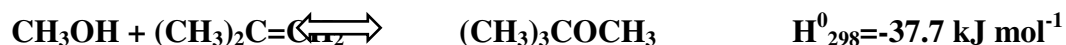


Fig-1 CONVENTIONAL PROCESS

COMMERCIAL PROCESS:

Conventional processes for the manufacture of MTBE (see Figure 1) use a catalytic reactor with a slight excess of methanol. The products correspond to the near-equilibrium conversion of about 90-95%. The reaction mixture is separated using distillation, but suffers from complications resulting from the formation of binary azeotropes methanol-MTBE and isobutylene-methanol. The unreacted isobutylene is also difficult to separate from other volatile C₄ products. With the reactive distillation process, almost complete conversion of isobutylene is obtained, thereby eliminating the separation and recycle problems. Figure 2 provides a schematic representation of this process. A fixed-bed pre-reactor is used to achieve near-equilibrium conversion. The product

stream equivalent to the equilibrium conversion is fed to the reactive distillation column, wherein, the residual amount of isobutylene is reacted with methanol. The reactive distillation column is composed of three sections, the middle of which is a reactive zone packed with a solid catalyst. The top nonreactive rectifying section performs the separation of inert gases and excess methanol, while the bottom section separates out MTBE in pure form. The boiling points of MTBE and methanol are 328 K and 337.5 K, respectively. This may seem surprising, as MTBE is the bottom product while unreacted high boiling methanol is collected through the distillate. The behavior is caused by the formation of an MTBE-methanol low boiling azeotrope, which lifts methanol from the stripping section of the column. The pioneering work to commercialize this technology was performed by Smith from Chemical Research and Licensing Company, who has been awarded several patents for different catalyst structures, column internals design and Sowing schemes. Some patents have also been assigned to researchers from ELF who claims to have used alternating catalytic and non catalytic zones successfully to carry out the etherification. The efforts in these studies were directed towards minimizing the pressure drop in the catalyst bed and providing maximum residence time for the liquid in the catalytic zone. This was achieved by providing separate free passage to the up Sowing vapour stream either by packing the catalyst in the down comers or by providing annular space in the catalyst bed, thereby isolating reaction and distillation zones in a single column.

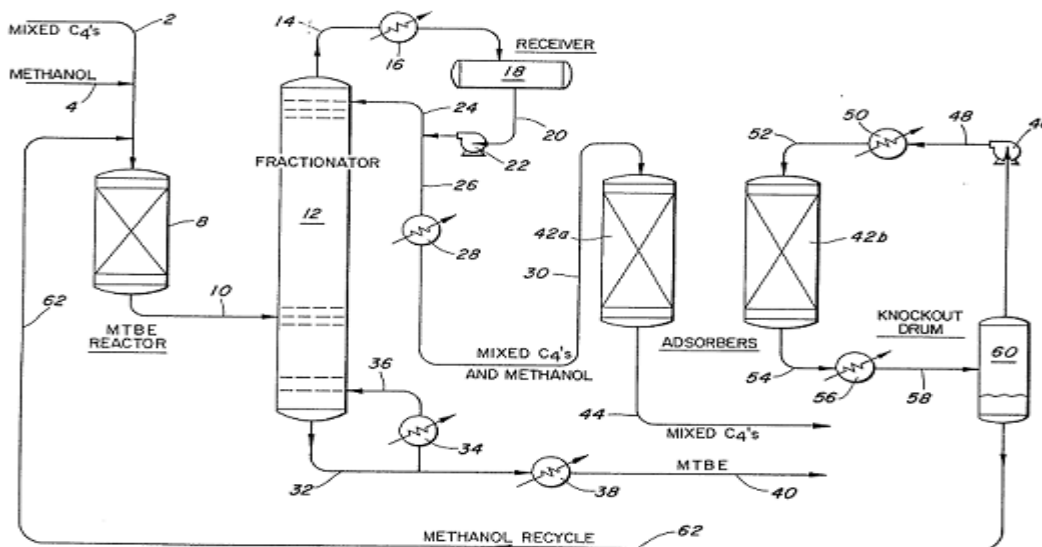


Fig-2 COMMERCIAL PROCESS

CONCLUSION

Reactive distillation offers several benefits over conventional processes for MTBE and methyl acetate manufacture. The commercial success of MTBE manufacture by reactive distillation has led to numerous investigations in the recent past on almost every aspect of this process. The generation of kinetic and equilibrium data at boiling temperatures, simulation and design studies, control strategies and identification of new reactions as candidates for reactive distillation, are some of the areas being investigated. Simulation studies of catalytic distillation for etherification have highlighted the important aspects of steady state multiplicity. This concept carries a special significance and plays an important role in design methods. Future work on simulation will see other reactions displaying this unusual phenomenon. Eastman Kodak has demonstrated the feasibility and advantages of reactive distillation at the commercial scale for methyl acetate manufacture. The process has scope for improvement in the sense that solid acid catalyst can be employed instead of sulfuric acid. Different techniques of confining the small beads of ion exchange resin in fiber glass cloth, wire mesh or structured packing have been developed. These catalysts offer very good vapor-liquid contact and activity but replacing the deactivated catalyst would be labor-intensive and time-consuming. The future focus should be on development of a catalyst in the form of a conventional column packing, such as Rachig rings, which would have good mechanical strength, activity and stability under the reaction conditions. Reactive distillation may find a place in many other processes such as hydrolysis of methyl acetate, recovery of carboxylic acid from their aqueous solutions, hydrodesulphurization and purification of phenols.

The Response Surface Methodology

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Abstract:

Experimentation is a part of scientific method that requires observation and gathering information about the working of system. Such a method is Response Surface Methodology which is the approximation of response function $y=f(x_1, x_2, x_3 \dots x_q) + e$. RSM is a collection of mathematical and statistical techniques for empirical model building. This approximation is considered when the true relationship between y and x 's might not be known and follows Least Square Method of approach. In this paper, RSM designing, modelling, formulation and analyzing is discussed and an overview of its applications in various engineering fields will be provided. RSM types namely the first-order, the second- order and three level fractional factorial are analyzed with relevant applications respectively. The applications of RSM include Automotive Suspension Designs, optimization of systems, CFD analysis and many more. Concerning all these factors, this paper points the Response Surface Methodology (RSM) as an objective to optimize a response (output variable) which is influenced by several independent variables (input variables). RSM can be integrated in many large scale simulation systems such as Bio War, ORA and currently integrating in Vista, Construct and DyNet. This paper describes theoretical approach of solving problems in optimization and implementation of chosen methods.

Keywords: Response Surface Methodology, Least Square Approximation, Response Function, Fractional Factorial

INTRODUCTION:

Response surface methodology (RSM) uses various statistical, graphical, and mathematical techniques to develop, improve, or optimize a process. The most frequent applications of RSM are in the industrial area, where several predictor variables are used to predict some performance measure or quality characteristic of a product or process. As an important subject in the statistical design of experiments, the Response Surface Methodology (RSM) is a collection of mathematical and statistical techniques useful for the modeling and analysis of problems in

which a response of interest is influenced by several variables and the objective is to optimize this response

$$y = f(x_1, x_2) + e$$

The variables x_1 and x_2 are independent variables where the response y depends on them. The dependent variable y is a function of x_1 , x_2 , and the experimental error term, denoted as e . The error term e represents any measurement error on the response, as well as other type of variations not counted in f . It is a statistical error that is assumed to distribute normally with zero mean and variance s^2 . In most RSM problems, the true response function f is unknown. In order to develop a proper approximation for f , the experimenter usually starts with a low-order polynomial in some small region. If the response can be defined by a linear function of independent variables, then the approximating function is a first-order model. A first-order model with 2 independent variables can be expressed as

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + e$$

If there is a curvature in the response surface, then a higher degree polynomial should be used.

The approximating function with 2 variables is called a **second-order model**

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{11} x_1^2 + \beta_{22} x_2^2 + \beta_{12} x_1 x_2 + e$$

In general all *RSM* problems use either one or the mixture of the both of these models. In each model, the levels of each factor are independent of the levels of other factors. In order to get the most efficient result in the approximation of polynomials the proper experimental design must be used to collect data. Once the data are collected, the *Method of Least Square* is used to estimate the parameters in the polynomials. The response surface analysis is performed by using the fitted surface. The **response surface designs** are types of designs for fitting response surface.

Therefore, the objective of studying *RSM* can be accomplish by

(1) Understanding the topography of the response surface (local maximum, local minimum, ridge lines), and

(2) Finding the region where the optimal response occurs. The goal is to move rapidly and efficiently along a path to get to a maximum or a minimum response so that the response is optimized.

TYPES OF MODELS:

THE FIRST-ORDER MODEL:

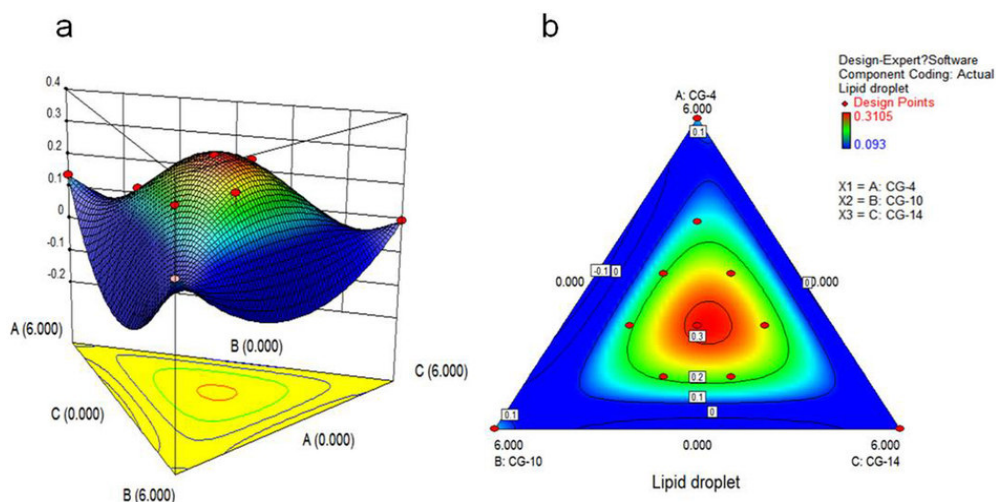
A first-order model uses low-order polynomial terms to describe some part of the response surface. This model is appropriate for describing a flat surface with or without tilted surfaces. Usually a first-order model fits the data by least squares. Once the estimated equation is obtained, an experimenter can examine the normal plot, the main effects, the contour plot, and ANOVA statistics (F-test, t-test, R^2 , the adjusted R^2 , and lack of fit) to determine adequacy of the fitted model. Lack of fit of the first-order model happens when the response surface is not a plane. If there is a significant lack of fit of the first-order model, then a more highly structured model, such as second-order model, may be studied in order to locate the optimum.

THE SECOND-ORDER MODEL:

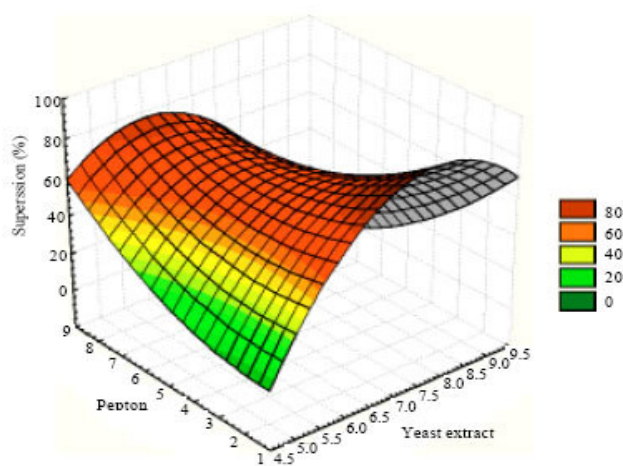
When the first-order model shows a significant lack of fit, then an experimenter can use a second-order model to describe the response surface. There are many designs available to conduct a second-order design. The central composite design is one of the most popular ones. An experimenter can start with 2^q factorial point, and then add center and axial points to get central composite design. Adding the axial points will allow quadratic terms to be included into the model. Second-order model describes quadratic surfaces, and this kind of surface can take many shapes. Therefore, response surface can represent maximum, minimum, ridge or saddle point. Contour plot is a helpful visualization of the surface when the factors are no more than three. When there are more than three design variables, it is almost impossible to visualize the surface. For that reason, in order to locate the optimum value, one can find the stationary point. Once the stationary point is located, either an experimenter can draw a conclusion about the result or continue in further studying of the surface.

RESPONSE SURFACE METHODS AND DESIGNS:

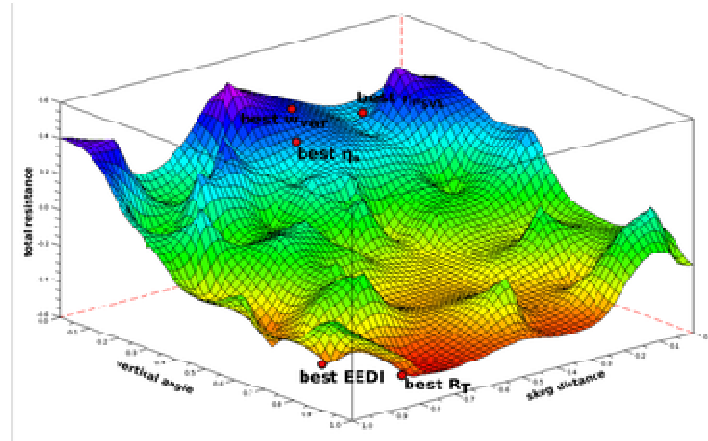
LIPID MODULATORY ACTIVITIES OF CICHORIUM GLANDULOSUM BOISS ET HUET



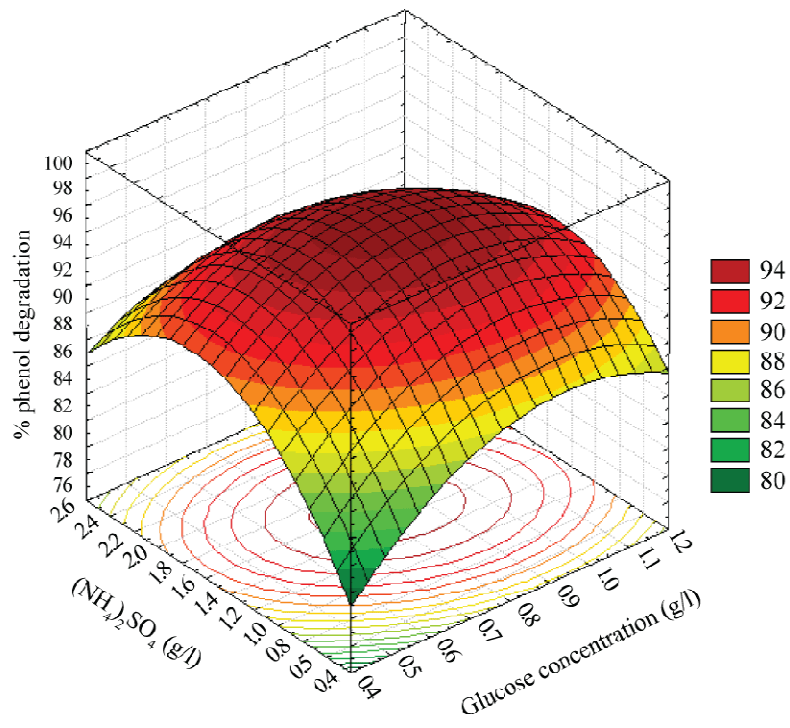
OPTIMIZING THE PRODUCTION OF ANTIMICROBIAL AGENTS FROM BACILLUS LICHENIFORMIS



VISCOUS OPTIMIZATION OF BULKERS AND TANKERS



FOR PHENOL DEGRADATION



Gauze Reactor: Application and Modelling Aspects

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Abstract:

Fast occurring reactions are often controlled by external Mass transfer. In such a case, the use of porous catalyst is not effective as it results in massive wastage of catalytic material, which necessitates the use of metal wire gauzes as a catalyst support. Concerning this, Gauze reactors assume importance with regard to compact design, fulfilling the requisite properties and needs of industries. The major applications of Gauze reactors include oxidation of ammonia, Catalytic Partial Oxidation of methane, control of NO_x emissions from stationary engine fuelled with biomass gas and Oxidation of methanol to produce formaldehyde. A model of wire Gauze reactor is designed by 3D numerical simulations as well as micro kinetics. The heat and mass transfer characteristics of the wire gauze reactors with reaction mechanism are also discussed in contrast to the properties of other conventional reactors.

INTRODUCTION:

Catalysed reactions and oxidation processes are most common in the chemical process industries which use a wide range of reactors based on requirement. In this regard, rational modelling of reactors is utmost requisite. Different reactions like batch reactors, plug reactors, packed bed catalytic reactors, continuous reactors etc., for various applications are available. Nowadays, we are using catalyst to enhance the rate of reaction and to obtain the products in less time. But, it is observed that, in reactors due to external mass transfer there is massive wastage of catalytic material and sometimes the catalyst is not effective. Such problems arise mostly in fast occurring reactions. Viewing all economic and safety consideration, the reactor design can be modified using wire gauzes as catalyst support. Such reactors are called Gauze reactors. In Gauze reactors, the gauzes act as catalyst and structured internals offer a number of advantages over other catalytic reactors. The use of Gauze reactors results in low consumption of catalytic material, less reactor volume, faster reaction rate.

MODELLING:

Modelling of Gauze reactors is done by 3D simulations and the micro kinetics. Here a model of Gauze reactor will be explained by typical application: catalytic partial oxidation (CPO) of methane over Ni gauze. The CPO of methane can be modelled by three-dimensional numerical simulations of the flow field coupled with heat transports as well as detailed gas-phase and surface reaction mechanisms.

NUMERICAL MODEL:

Modelling the gauze reactor involves a numerical solution of the Navier–Stokes equations, in which detailed surface and gas phase reaction mechanisms are integrated. Gas-phase and surface

chemistry is coupled by adsorption and desorption of stable and radical species. For each chemical species one additional conservation equations is solved. The dependence of the transport properties such as viscosity, diffusion coefficients, and heat conduction on composition and temperature is taken into account. The heat balance considered heat convection, conduction in the gas- and solid-phase, and heat release by chemical reactions. Modified Arrhenius expressions are assumed to model the reaction rate in the chemical source terms. The thermodynamic data were obtained by polynomial fits.

The flow field was computed using the commercial computational fluid dynamics code FLUENT which was coupled with external subroutines (user defined functions = UDFs) to model gas-phase and surface chemistries based on the software package DETCHEM . With the usage of this software and its user defined function there is keen possibility to numerical iteration for all computational cells which is further useful in determining the reaction rate of each species. At a given temperature and pressure , from reaction mechanism of elementary step it is simpler even to calculate the reaction rate locally (enthalpies are provided). DETCHEM is is such a software package which is very useful in providing the surface mass fluxes of each component due to adsorption, desorption, reaction enthalpies etc, In combination with this, surface mass fluxes can be categorized and evaluated by numerical iteration.

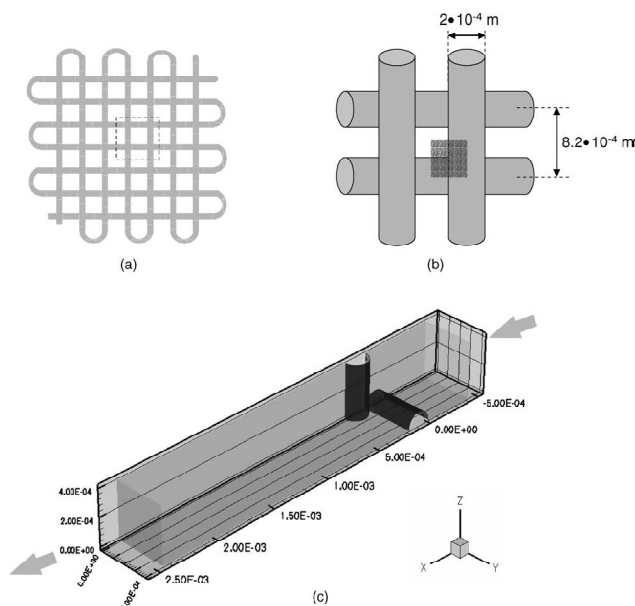


Fig.1. Sketch of the platinum gauze: (a) original gauze and (b) detail of wire intersections, where the shadow area corresponds to the selected computational domain presented in (c).

REACTION MECHANISM:

Based on the reaction operating at desired conditions, the reaction mechanism is chosen so as to get the desired product in lesser steps of procedure. Concerning one of the applications of the Gauze reactor, the partial oxidation of methane is especially proceeded and is catalysed by number of metal surfaces, thickness of bed pf gauzes. To meet the yield of output, it is utmost

required to convert maximum extent of reactants. Thus, the conversion of methane can be increased by increasing the temperature of reaction mixture as well as lowering the feed input CH₄/O₂ ratio. The reaction mechanism of partial oxidation proceeds as:

- Cleavage of C - H bond at the catalyst surface. This leads to high reactive CH₃ species.
- Methyl groups combine with surface oxygen finally responsible for formation of CO and CO₂.
- The whole coupling (oxidative coupling) process occurs only at the catalyst surface.
- The recombination of divided methyl free radicals combine to form C₂H₆ on the catalyst surface as well as in gas – phase.

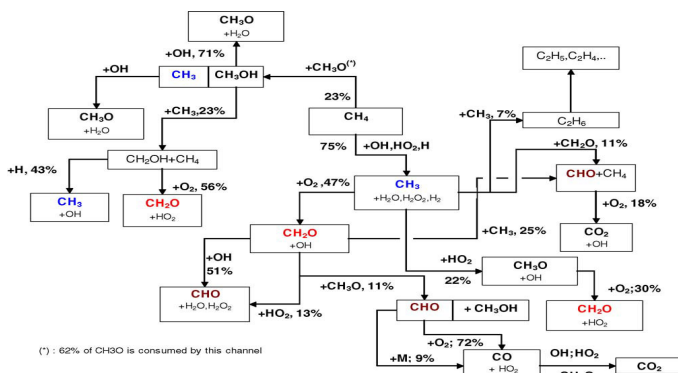


Fig.2: Reaction path analysis of methane oxidation in gas – phase (1050K, 1 bar, methane conversion = 5%, CH₄/O₂ = 2.5(volume ratio))

GAS – PHASE REACTION MECHANISM:

The gas-phase reaction mechanism is well elucidated from ordinary reaction mechanism following the total oxidation of C1 – C4 alkanes at higher temperatures (>1200K). This mechanism can be extended by an additional set of automatically generated elementary steps occurring even at lower temperatures. Further it can be extended in a secondary manner based on the experimental studies of oxidation of methane and reforming of single component fuels (methane, ethane, propane, butane etc.) including their mixtures also. For CPO of methane, the gas- phase mechanism consists of 1428 irreversible reactions among 146 species. The reaction mechanism was simplified in order to speed up the CFD simulation. From the CFD analysis, the predicted simulations are shown below:

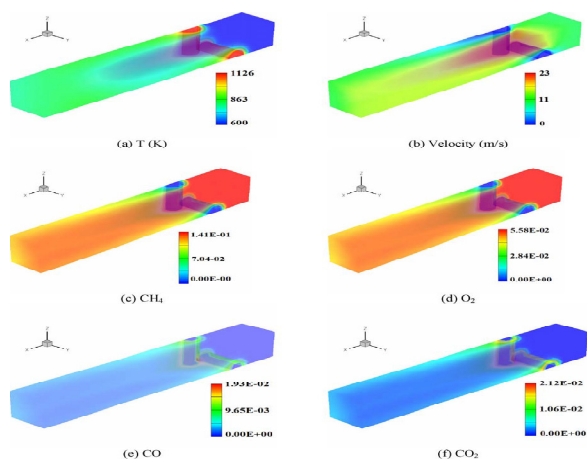


Fig.3. Numerically predicted contour profiles of temperature, magnitude of velocity, and mole fractions of the major species. Conditions: CH₄/O₂ vol. ratio = 2.5, axial inlet flow velocity = 10 m/s, inlet temperature = 600 K, and pressure = 1.3 bar

CONTROL PARAMETERS:

It is always necessary to maintain the reaction and the whole reactor under optimum conditions. In this regard, there are some parameters which show control over the designing as well as reaction mechanism. Such parameters are Control parameters and have control over the extent of conversion in Gauze reactor. The vital control parameters are:

- Numbers of gauzes used (for good efficiency about 2 to 30 or more are used at a time)
- Thickness of bed
- Total contact time
- Reactor Diameter

CONCLUSION: Not only CPO of methane, but also many gauze reactor applications like oxidation of ammonia, control of NO_x emissions from stationary engine fuelled with biomass gas and Oxidation of methanol to produce formaldehyde etc., can be modelled. However the study of reaction mechanism and micro kinetics need a detailed elucidation. Simulations successfully linked the interaction between the gas-phase mechanism and the surface mechanism through molecular and radical species involved in the process and the flow around the wire catalyst. For typical CPO conditions, heterogeneous steps govern the overall reactor performance. Thus, Gauze reactors have become a novel reactor models in handling the catalytic problems and for efficient run of reactor with easy modelling.

IMPACT OF SOLID WASTE ON GROUND WATER & SOIL

DUNGI JOSHNA

Solid wastes such as household wastes, agricultural wastes, hospital wastes, industrial wastes produced from the urban areas are dumped into the near-by dumpsites or landfills. The most commonly used treatment is solid waste land filling. By these dump yards many diseases give birth and also harmful chemicals are released. It contaminates the ground water and even loses the fertility of the soil. It is important that these wastes are identified and managed to protect ourself and others in the community as well as the environment. As a waste generator we are responsible for the all the wastes generated at our site including hazardous and non-hazardous wastes.

SOLID WASTE MANAGEMENT:

Solid waste is being produced from the beginning of civilization. Solid wastes were conveniently disposed in large open land spaces, as the density of the population was low. However, today, as one of the consequences of global urbanization there is an increased amount of solid waste. About 1.3×10^9 t of municipal solid waste (MSW) was generated globally in 1990 and, at present, the annual generation is approximately 1.6×10^9 t. Usually a larger urban population results in a larger amount of solid waste generation, which is a common feature in developing countries. Improper disposal of waste has huge social costs due to the spread of communicable diseases and increased treatment costs for pollutants. In India, collection, segregation, transportation, and disposal of solid waste are often unscientific, complete disorder and confused. Uncontrolled dumping of wastes on the outskirts of towns and cities has created overflowing landfills, which have environmental impacts in the form of pollution to soil, groundwater, air and also contribute to global warming. Urban "Municipal Solid Waste" is usually generated from human settlements, small industries and commercial activities. An additional source of waste that finds its way to MSW is the waste from hospitals and clinics. In majority of countries most of the smaller units do not have any specific technique of managing these wastes. In developing countries open dumpsites are common, due to the low budget for waste disposal and non-availability of trained manpower. Open dumping of MSW is a common practice. It also poses serious threat to groundwater resources and soil. The contamination of soil by heavy metal can cause harmful effects on human health, animals and soil productivity. Over the last many years, heavy metals have considerably damaged the soil quality and fertility in consequence of increased environmental pollution from industrial, agricultural and municipal sources. Waste carries different metals which are then transferred to plants by different ways. Depending on the tendency of the contaminants they end up either in water held in the soil or leached to the underground water. Diversity of vegetation is directly influenced by soil characteristics. Soil consistence described in terms of the soil conditions at different water states, e.g. dry or hard, semi-solid, moist, plastic, wet and viscous. These states and limits refer to medium and fine-textured soils.

SOLID WASTE CATEGORIES:

a) HOUSEHOLD WASTES:

Solid waste comprising of Bottles, Cans, Clothing, Compressed food scrap, Newspapers, Magazines, Yard trimmings these originate from homes and apartments.

b) AGRICULTURAL WASTE:

The waste produced on a farm through a various farming techniques. These techniques includes: Horticulture, Seed growing, Life stock building, grazing land, Markets, Nursery plots, Wood lands etc.

c) INDUSTRIAL WASTE:

Waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process. Such as Factories, Mills, Mining process

d) HOSPITAL WASTES:

Hospital and other medical wastes include the waste generated from Health care centers, Medical laboratories and Research centers. Such as syringe needles, bandages, swabs, plasters and other types of infectious waste.

GROUND WATER:

Water is a gift of god of nature and is believed to have no enemies. Despite the abundance of fresh water on earth many regions are in deep crisis of water shortage due to the pollution caused by human activities, ever increasing demand by industrialization and high population growth. Ground water resources include shallow and deep rechargeable & renewable aquifers that are connected to reverse streams and seas. Ground water makes up about 95% of world's fresh water supply excluding fresh water in globalize.

Characteristics of Ground Water depend upon the geological nature of the terrain.

- Ground water is very poor microbiologically.
- The ground water is assumed to be free from contamination but recent studies have proven that the assumption is wrong.
- Toxicological studies have found pesticides and contaminants in underground water resources which are nearer to the Dumping & Landfill areas.
- Water pollutant is a chemical, physical substances present at excessive level capable of causing harm to living organisms.

SOIL:

It is a natural dynamic body comprising the upper most layer of earth's crest which consists of mineral and organic compounds, water and air. Soils are formed in response to atmospheric and biological forces. Soil pollution near the landfill arise due to leaching of most common pollutants like copper, lead, mercury, cadmium etc.

PREVENTIVE MEASURES:

a) HOUSEHOLD WASTES:

The house hold wastes can be segregated as wet and dry ones where the wet organic matter can be kept aside for the composting which can be used as fertilizer. The dry waste is mostly recyclable and even can be used to generate electricity.

b) AGRICULTURAL WASTES:

The agricultural waste can be minimized by using techniques like rotational grazing & reuse of animal waste in farming operations. By putting into practise the principles of 4hours Reduce, Reuse, Recycle, and Recover. Recycle and Recover is the 1st and best option.

c) INDUSTRIAL WASTES:

Arsenic in mining. Lead in lead acid batteries smelters. By addition in properly designed insinuator which reduces the toxicity and volume of the waste. The non-hazardous wastes from various industries are non-toxic as house hold wastes and it can be used in the production of energy and biogas by various treatment processes.

c) HOSPITAL WASTES:

Hospital wastes can be minimized by using disinfectants and using things which can be recycled so that it is no longer a source of infection. They can also be recycled into those items which can be used. The biomedical waste which is hazardous after proper treatment that can be deeply buried and the process of insinuation and microwave treatment are to be followed depending on the waste. The plastics used in the hospitals wastes can be shredded.

CONCLUSIONS

Ideally the dump sites should be placed. The landfill sites should be well lined and walled to ensure that there is no leakage into the nearby ground water sources. Storing waste in covered areas, preferably bundled, to avoid possible leakage of liquid components into the environment or worse still, mixing with other incompatible chemicals and forming toxic gases or explosive mixtures. Ensuring the hazardous waste materials is stored away from working areas and nearby residential areas. Labelling the waste components in each storage container clearly and ensuring that staff is trained in chemical safety procedures related to the chemical constituents.