SNJB's

LATE SAU. K. B. JAIN

COLLEGE OF ENGINEERING

NEMINAGAR, CHANDWAD, DIST- NASHIK

NAACC ACCREDITED WITH "A" GRADE

Founder

Poojya kakaji

Department of Mechanical Engineering

Yantra Veda

Year 2020-21

Shri. Dineshji Lodha

Shri. Zumbarlalji Bhandari

Shri. Sunilji Chopda

Message from Honourable Management

We feel delighted to observe that yearly Technical Magazine "YANTRAVEDA" from department of Mechanical Engineering is to coming out in this year (A.Y.2020-21), thanks to efforts of the faculty and the students of the department. The "YANTRAVEDA" is truly the reflection of the interest of the students, involved in technical endeavors.

As a parting message to students of Mechanical Engineering, We wish them a pleasant and prosperous future and advise them to develop deep in their career and come out with the pearl of name and fame ,both for themselves and their future.

Message from Principal

I am proud to announce the release of 'YANTRAVEDA' magazine's fifth issue. The magazine signifies the writer's penmanship and also allows them to share their ideas. I acknowledge the efforts of students and staff of Mechanical department who have taken the initiative to promote the writing and publishing skills of the students. This helps the students to share and express their ideas in an articulate manner. Students and staff achievements have also been presented which will be a motivational factor for the other students to achieve the standard of excellence. Glad to say that we have achieved our aim of turning this into reality. I would like to congratulate all the students, teachers, alumni and everyone involved in bringing out its 5th edition.

Wishing everyone loads of success and bright future.

Dr. Mahadeo Kokate

Message from Head of Department

I am pleased to know that our students are successful in bringing their fifth issue of magazine 'YANTRAVEDA' for this academic year 2020-21. YANTRAVEDA, the departmental magazine has the prime objective of providing aspiring engineers a wide platform to showcase their technical knowledge and to pen down innovative ideas.

This magazine is intended to bring out the hidden literary talents in the students and teachers to inculcate strong technical skills among them.

I congratulate and thank all the students and faculty coordinator who have made untiring efforts to bring out this magazine. I wish them all the very best for releasing more such magazines in future.

Dr. Santosh Sancheti

LATE SAU. KANTABAI BHAVARLALJI JAIN

COLLEGE OF ENGINEERING

NEMINAGAR, CHANDWAD, DIST- NASHIK

NAAC ACCREDITED BY “A” GRADE

ESTD - 1928

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

- To impart quality technical education in the field of Mechanical Engineering for the benefits of society

MISSION

- To provide quality education among the students through the curriculum and industrial exposure.
- To develop a learning environment leading to innovations, skill development and professional ethics through curricular and extracurricular activities for societal growth.

PEO'S AND PSO'S

Program Educational Objectives (PEOs):

After industrial experience of 4 to 5 years, Mechanical Engineering graduates will be able to

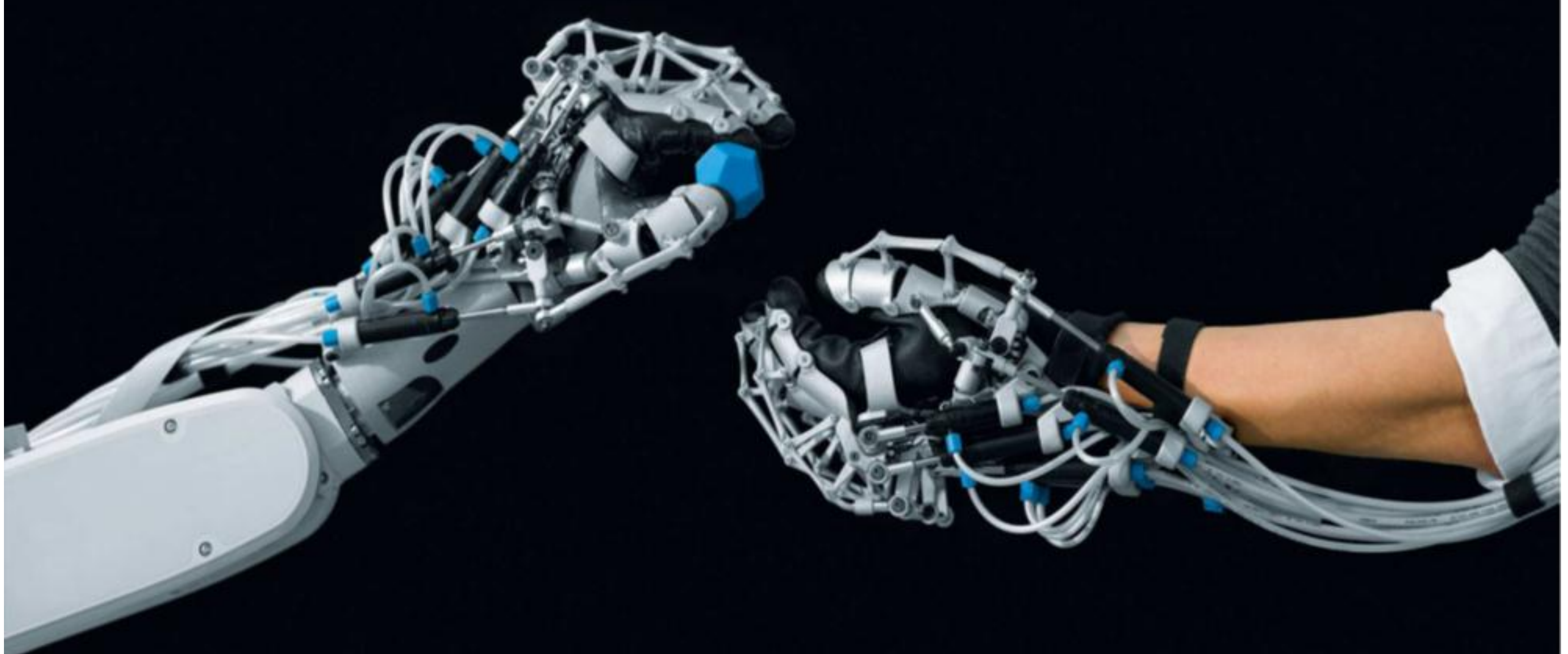
1. **Graduates will possess essential professional Mechanical Engineering skills to develop solutions for industrial and societal problems.**
2. **Graduates will engage and succeed in their professional careers through teamwork, professional ethics and effective communication.**
3. **Graduates will engage in lifelong learning, career enhancement and adapt to emerging technologies for the benefits of society.**

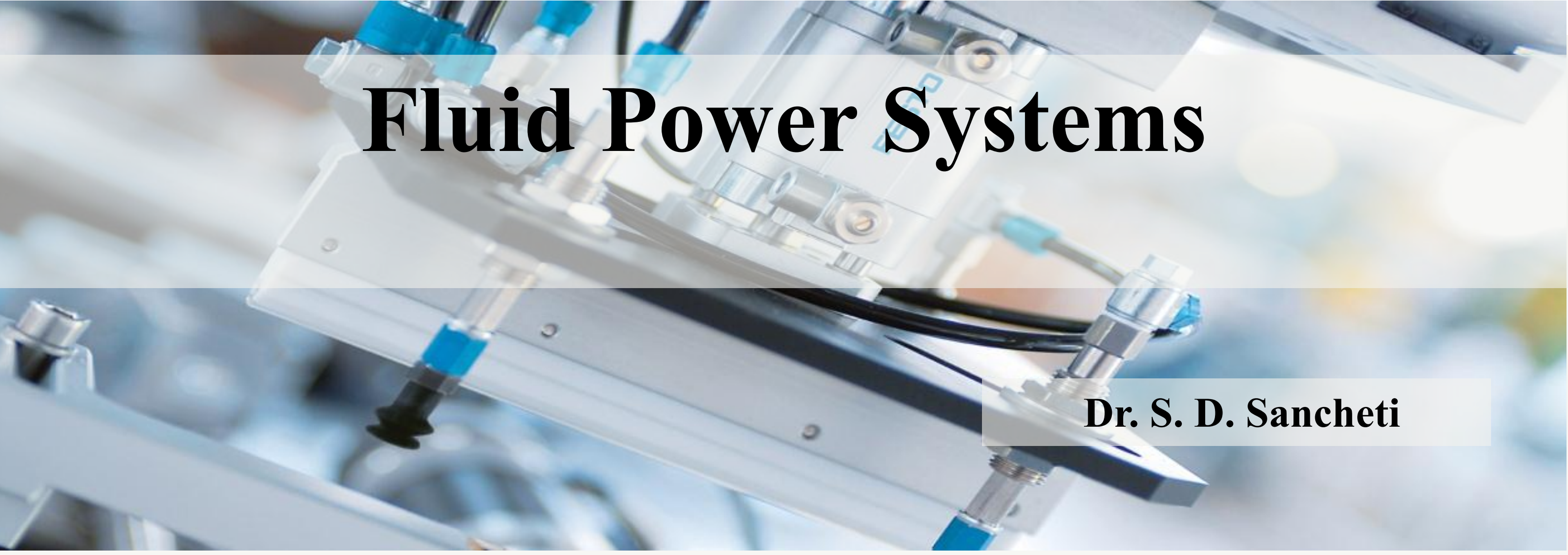
Program Specific Outcomes (PSOs):

After graduation, Mechanical Engineering graduates will be able to

1. **Graduates will have an ability to identify, analyse, and develop appropriate solution(s) to Mechanical Engineering Problems.**
2. **Graduates will be able to use modern engineering tools for analysing and solving practical problems of industry and society.**
3. **Graduates will be able to learn and grow constantly, with good technical, spiritual, and ethical values with a zeal for life-long learning.**

Faculty Articles

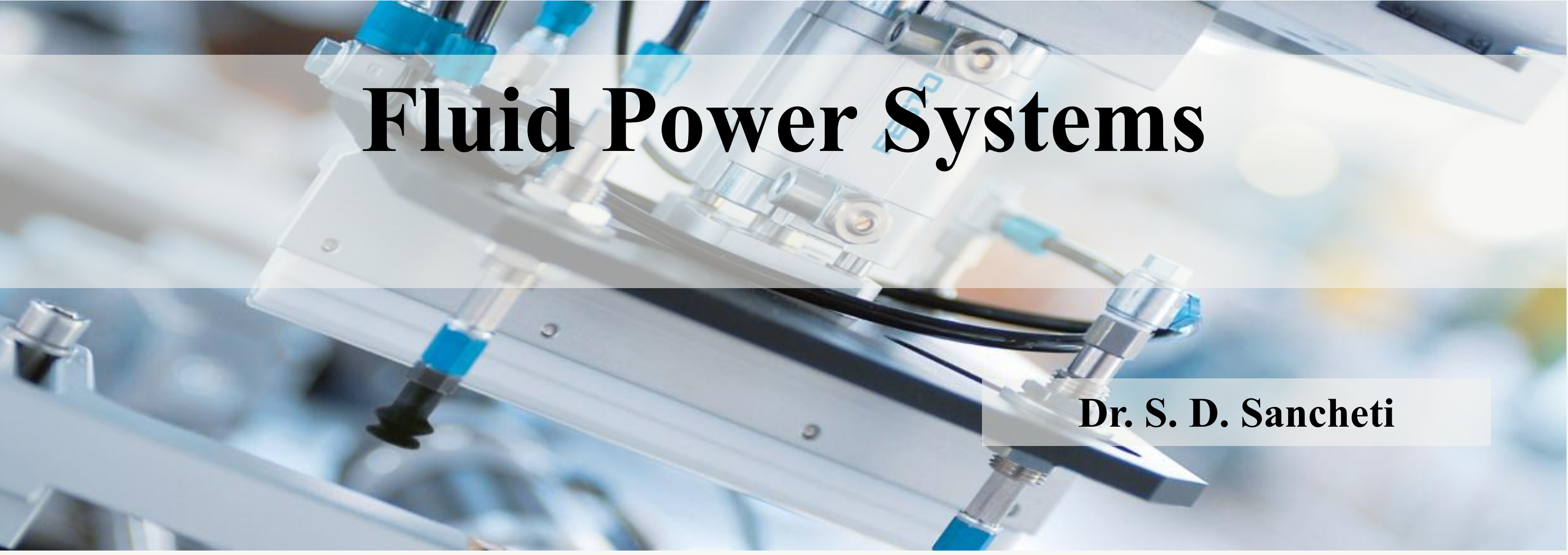




Fluid Power Systems

Dr. S. D. Sancheti

Engineers learn about mechanical and electric power transmission as part of their formal education. Mechanical power transmission controls different machine aspects such as force, torque, and speed from a prime mover—usually an electric motor or internal-combustion engine—to a driven element using gear, belt, or chain. Electrical power transmission regulates current, voltage, and frequency to deliver controlled speed, force, and torque to an output shaft. These technologies usually work together to produce a power transmission system that capitalizes on the unique strengths of both technologies. Unfortunately, most engineering schools in North America do not offer a curriculum covering the third type of power transmission—fluid power. The term fluid power was adopted more than 60 years ago to describe hydraulic and pneumatic systems for transmitting power. Analogies between fluid power and electrical systems can be an effective tool in teaching how fluid systems operate and can be designed. Both systems have their own distinct set of Get to Know Fluid Power Systems You probably studied fluid dynamics in school, but not about fluid power technology. Here's a lesson on the misunderstood method of power transmission. By Alan Hitchcox Caterpillar's 6090 FS mining excavator show cases the power and controllability of hydraulics in mobile equipment. This giant's five-circuit hydraulic system controls virtually every aspect of operation —the ground drive, swing function, arm and bucket control, and even engine cooling. Photo: Caterpillar advantages and disadvantages compared to mechanical and electrical drives. Engineers should understand what the possibility of using fluid power can bring.

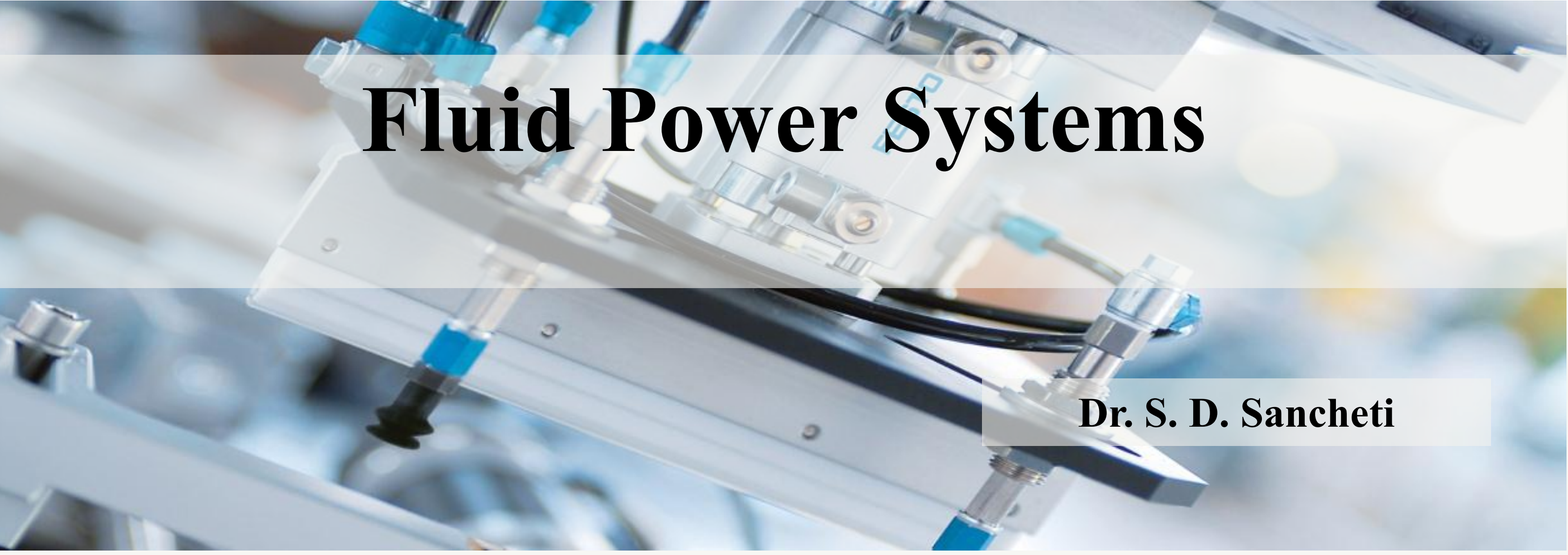


Fluid Power Systems

Dr. S. D. Sancheti

Fluid Power System Characteristics

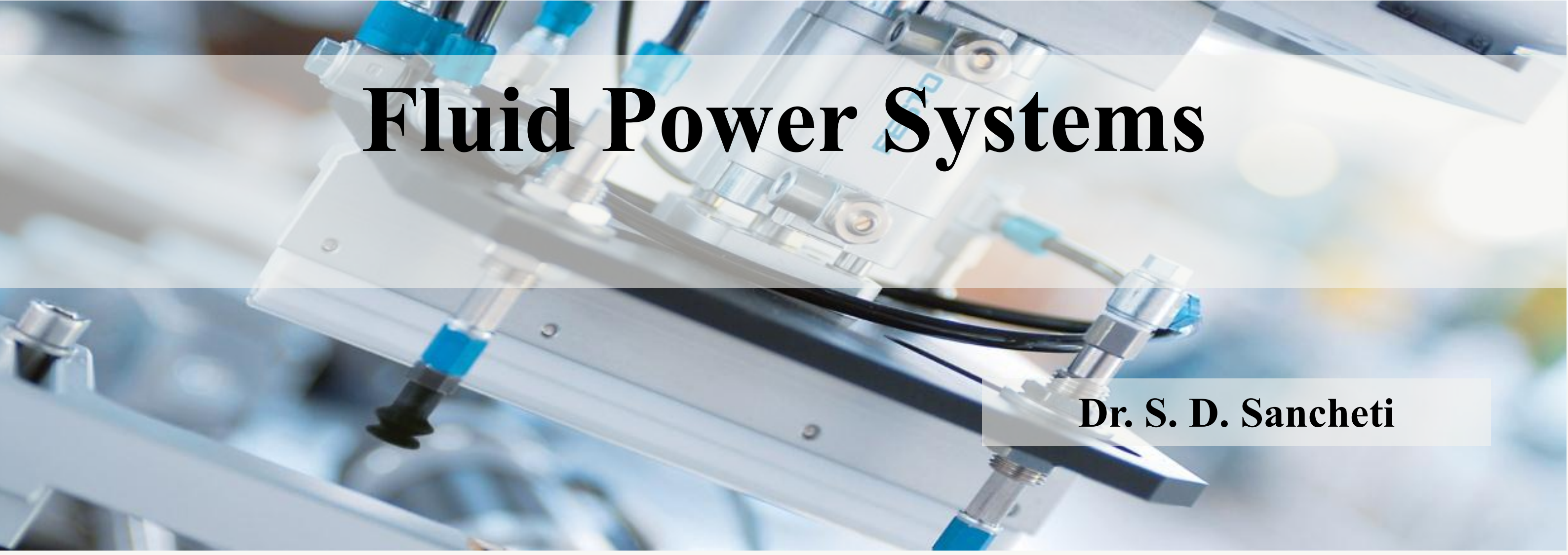
Fluid power technology uses a pump to deliver pressurized fluid to a cylinder, motor, or rotary actuator. Output speed and direction is controlled by varying flow rate from the pump or through valves within the fluid power circuit. Likewise, output force and torque are regulated by controlling pressure within the circuit. In fluid power systems, the molecules of fluid act much like electrons in electrical circuits to transmit power from an input to an output. For example, pressure and flow in a fluid power system are analogous to voltage and current in an electrical system. Fluid power systems also use a variety of directional controls valves, much like electrical circuits use switches. However, valves allow fluid current to pass when open, whereas switches enable electrical current to pass when they are closed.



Fluid Power Systems

Dr. S. D. Sancheti

Most hydraulic fluids exhibit a very high bulk modulus—a measure of resistance to compression, making fluid stiff so highly responsive motion and positioning can be achieved. Oil is the most widely used fluid in hydraulic systems, with water a distant second and other fluids for specialized applications. Compressed air is the most widely used in pneumatic systems and is highly compliant, which can produce sluggish or spongy operation, depending on the load and system design. The high-power density is the main reason why hydraulic power transmission continues to be widely used in commercial and military aircraft. The systems provide a compact and lightweight solution for operating flight surfaces, landing gear, steering, and other aircraft systems. Certain hydraulic systems can transmit more power from a smaller output actuator than electromechanical devices can. For example, a hydraulic motor rated for 25 hp typically is one-quarter the size and weight of an electric motor. Specifying a low-speed, high-torque hydraulic or pneumatic motor also eliminates the need for a gearbox to reduce speed and multiply torque output of the electric motor, increasing fluid power's higher power density even more. Hydraulic and pneumatic systems also excel at transmitting linear motion. A simple hydraulic or pneumatic cylinder transmits fluid pressure and flow directly into controllable force and speed with no need for a screw or other rotary-to linear motion conversion device. Furthermore, a properly sized hydraulic system can deliver a force measured in hundreds of tons with motion and position accuracy measured in thousandths of an inch.



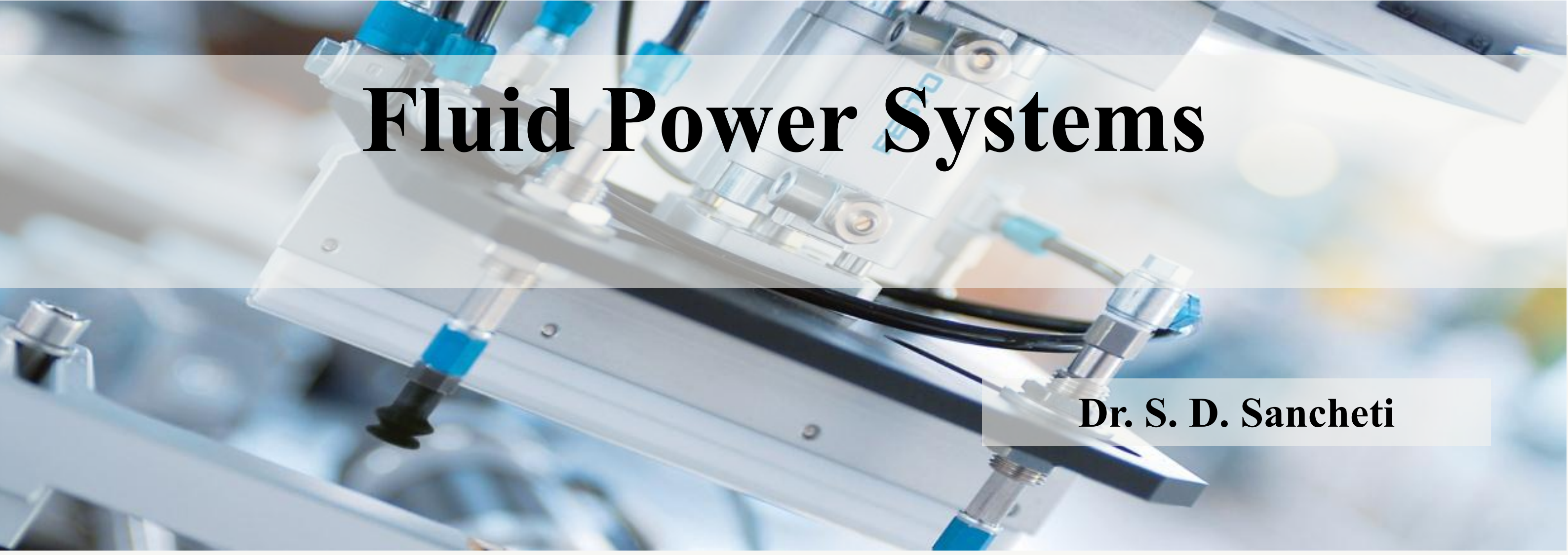
Fluid Power Systems

Dr. S. D. Sancheti

Because pneumatic systems typically operate at much lower pressures than their hydraulic counterparts, their power density advantage is not as great. However, compressed air is highly compliant, so pneumatic systems can operate with inherent cushioning to reduce shock transmitted to workpieces from impact. Pneumatic actuators can cycle back and forth rapidly with high repeatability and do so without the heat-buildup issues of electromechanical actuators or the potential hazards of electrical shock or ignition—offering clean operations. This makes them especially well-suited to pick-and-place, sorting, assembly, food processing, and other factory automation applications.

Limitations of Fluid Power

As with any other technology, fluid power systems have limits. Even though fluid power actuators themselves have a much higher power density than electromechanical actuators, hydraulic and pneumatic systems require a central power unit to convert electrical or mechanical power into pressure and flow. The power unit generally consists of a motor, pump, reservoir, valves, and filters. In most cases, the power unit is installed in a remote location, where generated heat and noise can be isolated and periodic maintenance performed. Fluid power systems generally operate with lower efficiency than equivalent electromechanical systems. An ongoing trend in fluid power system design incorporates electronic sensors and controls to improve efficiency and performance.



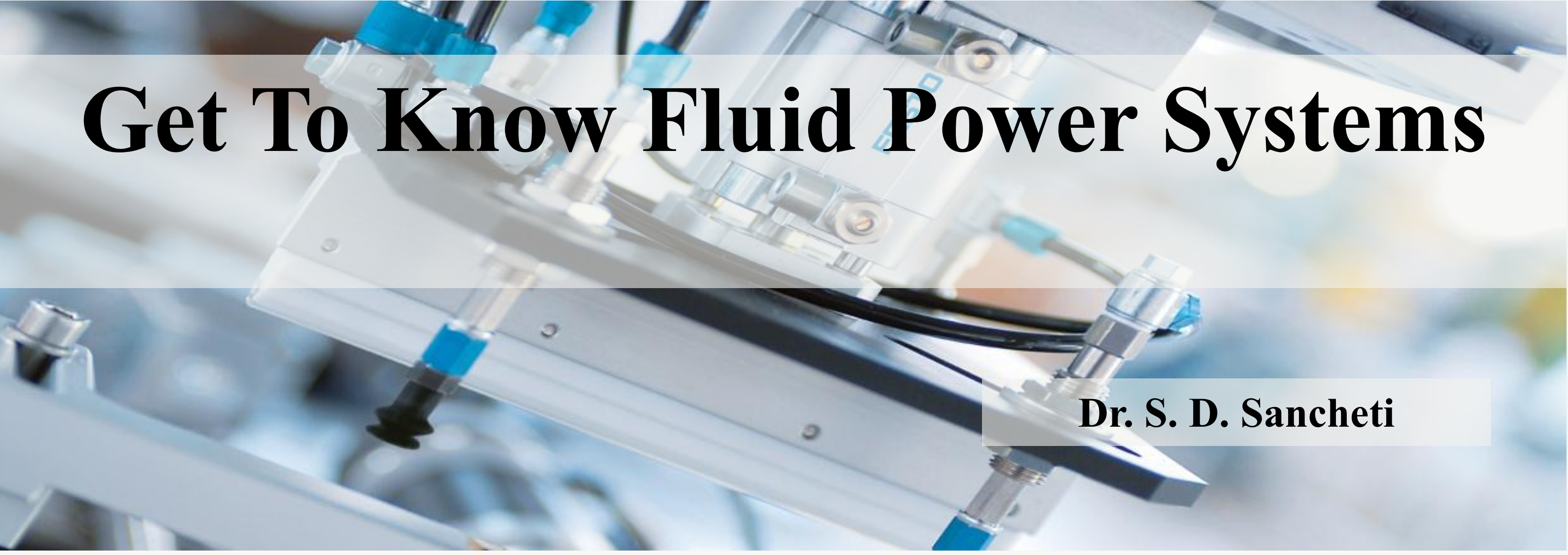
Fluid Power Systems

Dr. S. D. Sancheti

A more recent trend uses a variable-speed electrical drive powering the hydraulic pump instead of a fixed-speed motor. Fluid power systems—especially hydraulics—generally require more intensive maintenance, mainly to control leaks. Repeated pressure cycles can cause hydraulic fluid to leak from dynamic seals and fittings. However, leaks in pneumatic systems do not result in oil to accumulate; rather each leak represents wasted power, which reduces system efficiency. Fluid power components are designed with tight tolerances and narrow passageways, which makes them sensitive to contamination. Specifying filters to exclude and remove contamination is a critical to avoid erratic operation and a reduction in reliability.

Widespread Application

The application of hydraulic systems often brings to mind rugged and dirty environments. Hydraulics in construction and mining equipment—the technology's largest sector— involves heavy loads, heavy shock, and dirty environments. Stationary machines, such as industrial presses and cutting machines for example, also involve heavy loads and hostile environments. But hydraulics can also be found in much more delicate operations, such as aircraft and aerospace drives and even medical equipment. Pneumatics is also used in presses, but it is most prominent in conveying, packaging, labeling, and food processing automation.



Get To Know Fluid Power Systems

Dr. S. D. Sancheti

It's also widely used in medical equipment because of its clean operation and gentle application of force. Pneumatics is also inherently explosion-proof because it requires no electricity to operate—a popular choice for use in proximity to volatile substances. Hydraulic and pneumatic technologies are both considered mature industries, but they are by no means stagnant. New product developments, variable-speed drives, energy-efficient developments, and continued integration of IoT and Industry 4.0 capabilities ensure that fluid power technology will remain relevant for future generations.

Link : https://doi.org/10.1115/1.2020-OCT4

Clean Fuel From Nuclear Power

Dr. R. C. Patil

Hydrogen is the most abundant element in the universe, making up 74 percent of ordinary matter. Fittingly, it has myriad industrial uses. “You use hydrogen in the production of steel and petroleum refining. You use hydrogen in the support of vehicles that burn hydrogen in fuel cells. You use it for the production of ammonia fertilizers,” said Bruce Hallbert, director of the U.S. Department of Energy’s Light Water Reactor Sustainability Program Technical Integration Office at Idaho National Laboratory (INL) in Idaho Falls. “So, there’s a very large demand.” Significant as it is now, however, the opportunity presented by hydrogen could be much larger in the future. “Hydrogen has the highest energy content by weight of all known fuels, but because hydrogen is a small molecule, its energy density is about 50 percent less than methane,” Hallbert said. However, new methods to compress or liquefy hydrogen are being developed with lightweight, high-pressure tanks to make it possible to efficiently deliver this clean source of energy to filling stations and other specialty users. Right now, there are thousands of hydrogen fuel cells in commercial vehicles, forklifts, and backup power units throughout the United States. To get an idea of the potential demand for hydrogen fuel, consider that car and truck sales in the U.S. typically run about 16 million to 17 million vehicles annually. If a significant fraction of those were hydrogen powered, then the total demand for the fuel would be more than double what it is now.

But for that future shift to happen, many parts of infrastructure must be put into place, starting with the fuel itself. Virtually all the hydrogen available on Earth is bound to other elements in molecules. Extracting pure hydrogen from those compounds involves energy-intensive processes with significant carbon footprints. Now, the U.S. Department of Energy (DOE) and four commercial utilities are co-founding projects aimed at reducing the cost and impact of hydrogen production. The utilities are leading projects over the next few years to demonstrate technology to make hydrogen from water on an industrial scale using energy from operating commercial nuclear power plants. https://doi.org/10.1115/1.2020-JUL3

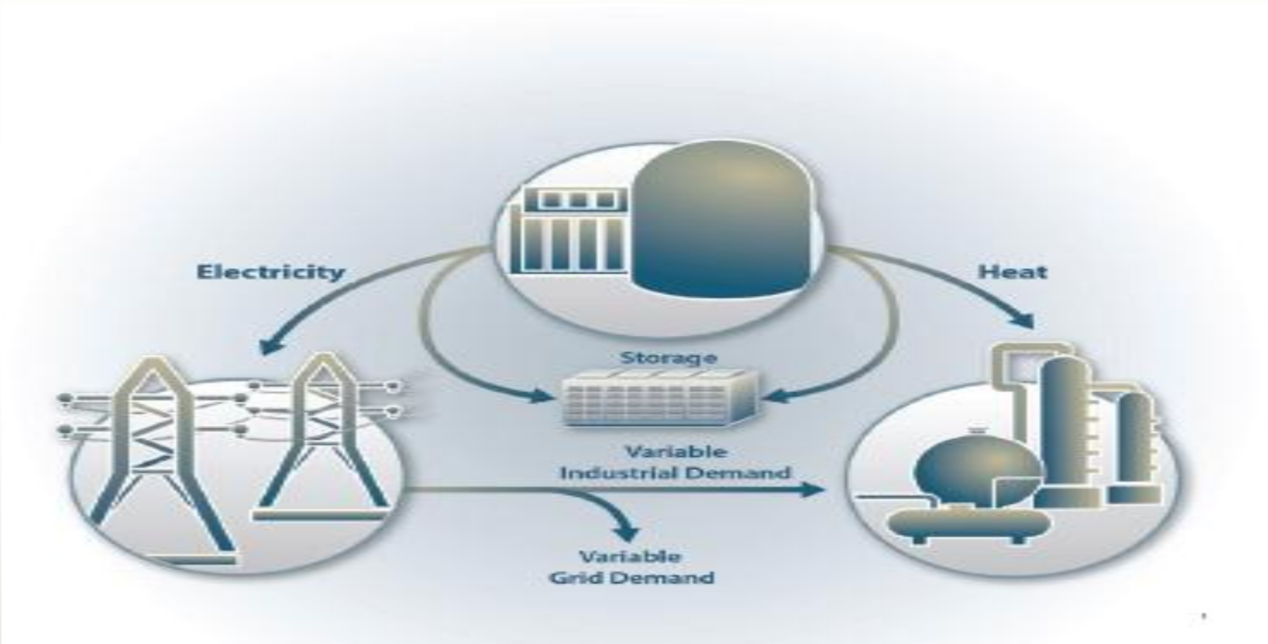
Clean Fuel From Nuclear Power

Dr. R. C. Patil

INL is also participating, having worked on the Clean Fuel from Nuclear Power Innovative engineering targets economical, carbon-free hydrogen production. by guest on 18 October 2021 concept for years under previous and current DOE national programs, including the Next Generation Nuclear Plant project, the Crosscutting Technology Development Integrated Energy Systems program, and the Light Water Reactor Sustainability (LWRS) program. If successful, these projects could lead to a day when hydrogen is produced economically and with no carbon emissions—and nuclear utilities have a new and reliable revenue stream.

Getting H2 to You

In recent years, between 60 million and 70 million metric tons of hydrogen is produced worldwide, with a sixth of that in the United States. Hydrogen is manufactured at industrial scale using steam reforming of a carbon-based feedstock, most commonly natural gas. The chemical reaction between a methane molecule and a water molecule produces three molecules of hydrogen and one of carbon monoxide. $CH_4 + H_2O \rightarrow CO + 3 H_2$



Clean Fuel From Nuclear Power

Dr. R. C. Patil

This reaction is strongly endothermic and so requires substantial heat. When done on an industrial scale, the process takes place in a reformer vessel where the feedstock and high-pressure steam are brought together at temperatures around 900 °C (1650 °F) in the presence of a nickel catalyst. To maximize production, the catalyst is shaped so that it has a high surface-areato-volume ratio. The carbon monoxide generated by the high-temperature process also can react with water, producing one molecule of hydrogen and one of carbon dioxide. $CO + H_2O \rightarrow CO_2 + H_2$ Ultimately, the steam reforming process results in the generation of carbon dioxide at a ratio of one CO_2 per four H_2 molecules. By weight, this means 5.5 tons of carbon dioxide are produced per ton of hydrogen. The ratio can be even higher, depending on the source of the energy for the high temperature steam; some reports put the weight ratio as high as 9:1. Since this carbon dioxide is generally vented into the atmosphere, hydrogen produced via steam reforming cannot be considered free of carbon emissions. Steam reforming accounts for 95 percent of current industrial hydrogen production, but there is an alternative way to

make hydrogen: electrolysis. A standard chemistry demonstration of this process passes a current through water, separating it into hydrogen, which collects at one electrode, and oxygen, which gathers at the other. The reaction—in which two water molecules produce two hydrogen molecules and one oxygen molecule—is strongly endothermic, requiring quite a bit of energy to complete. The great advantage of electrolysis is that no carbon-bearing feedstock is involved. Also, if the electricity source itself is free of carbon emissions, then the carbon footprint of the process is essentially zero. “Industrial scale electrolysis is predominantly performed at low-temperature using an alkaline electrolyte to optimize the cell conductivity,” said Richard Boardman, the technology development lead for integrated energy systems at INL. (Another low-temperature electrolysis process uses a polymer exchange membrane [PEM, sometimes called a proton exchange membrane] to separate hydrogen from water molecules.)

Clean Fuel From Nuclear Power

Dr. R. C. Patil

Today, commercial electrolysis is accomplished at low temperature, which often means cells are operated at 90 °C or less. But in some settings the electrolysis process is much more efficient when carried out at higher temperature, even as high as 800 °C with superheated steam.

Improving Efficiency

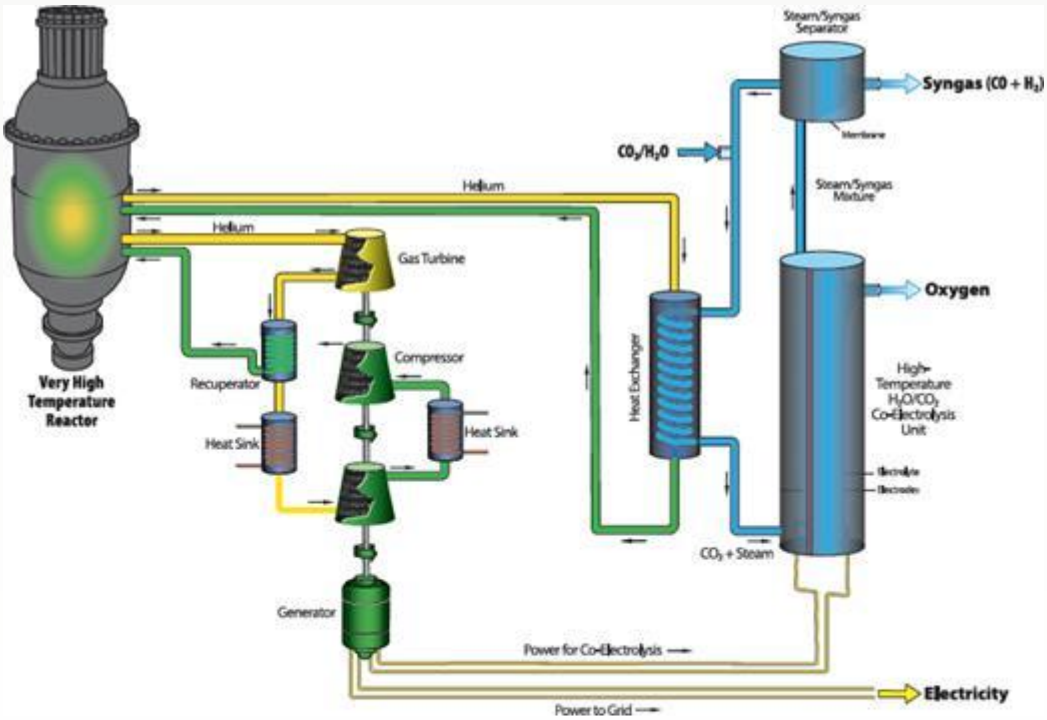
Low temperature alkaline electrolysis takes a minimum of about 52 kWh of electricity to make a kilogram of hydrogen, according to Boardman. Using a PEMbased approach cuts that figure to around 45 kWh per kg. (The energy content of 1 kg of hydrogen is around 33 kWh.) In contrast, using high temperature steam reduces the amount of electricity required substantially. “With high temperature steam electrolysis, the amount of electricity used can be reduced to around 35 kWh per kg—and even lower than that by providing high temperature heat to the electrolysis cell to compensate for the endothermic splitting of H_2O. With heat recuperation and cell heating, it could be possible to reduce the electricity used down to 30 kWh,” Boardman said. The roughly 30 percent increased efficiency is critical to lowering the cost of hydrogen produced by electrolysis. Some three quarters of that cost comes from the expense

of the electricity consumed. INL calculations show that at current wholesale prices of electricity around $30 per MWe, high-temperature electrolysis may cut the cost of hydrogen production to less than $2 a kilogram—a DOE goal. Thermodynamics lies behind the efficiency improvement. It takes less energy to convert steam into hydrogen and oxygen because the water is already in a gaseous state. In addition, at a superheated state, the bonds of the oxygen and hydrogen atoms are easier to break. Because the steam is already at a higher state of energy, it requires less electricity to finish splitting the steam molecules. The efficiency of transforming steam energy to electricity in a traditional large nuclear power plant is, at best, about 34 percent, Boardman said. So, avoiding that step and using steam heat in a more direct fashion improves the overall electrolysis system performance significantly.

Clean Fuel From Nuclear Power

Dr. R. C. Patil

The result is about a 40 percent increase in the amount of hydrogen that can be produced, according to calculations performed at INL using the power from actual nuclear power plants. In practice, such a high-temperature electrolysis plant would involve a heat transfer loop sitting between the nuclear power plant and the electrolysis unit. The loop would be filled with a working fluid that would transport heat out of the plant without compromising the safety or performance of the plant's existing systems.



Some design choices help achieve the results modeled by LWRS Program researchers. For instance, Boardman noted that nuclear plants produce steam at about 300 °C. With the intermediate heat transfer loop, the quality of the steam that is produced for electrolysis is around 250 °C. The question that is often raised is how much extra energy does it take to raise the temperature of this steam up to the electrolysis temperature of 800 °C? Boardman explained how that can be done with very little extra, or topping, heat.

Clean Fuel From Nuclear Power

Dr. R. C. Patil

“We use the heat from the hydrogen and the oxygen that’s coming out of that cell at 800 °C and send it through a heat exchanger to raise that incoming steam all the way to, maybe, 775 °C. This means very little electrical topping heating is needed to get the last little bump from 775 °C up to 800 °C. And that’s only one percent of the overall total energy,” Boardman said. He added, however, that this makes the system more complex: It now includes another heat loop and additional heat exchangers. That extra complexity is justified because the cost of energy is the largest expense in making hydrogen and the additional equipment is not expensive. The reduction in power used means high temperature electrolysis production of hydrogen can be cost competitive with that from steam reforming plants.

Improving Economics

Of course, the power for electrolysis can come from any source, including carbon-free solar or wind in addition to nuclear power plants. No matter what source, though, electrolysis benefits from lower electricity costs, and the price of producing power carbon free continues to fall. The International Renewable Energy Agency states that renewables are now a less expensive source of electricity than fossil fuels. Renewable energy is hampered by variability and intermittency. At times, renewable electricity production can fall to zero, while at other times the combination of wind and solar can produce power greater than the total electric demand. Hydrogen production offers a way to soak up extra generating capacity when it is present, thereby improving the economics of power production. In this, nuclear power plants have an advantage because they produce both electricity and steam. Thus, low- or high-temperature electrolysis facilities could be located adjacent to or near a nuclear power plant, with the connection made in such a way as to ensure safety of the plant and its operation. In practice, changes would have to be made to plant command and control systems as well as to plant simulators to accommodate this new function. This work is well underway, with national labs collaborating on needed tasks with industry partners.

Clean Fuel From Nuclear Power

Dr. R. C. Patil

Today, commercial electrolysis is accomplished at low temperature, which often means cells are operated at 90 °C or less. But in some settings the electrolysis process is much more efficient when carried out at higher temperature, even as high as 800 °C with superheated steam.

Improving Efficiency

Low temperature alkaline electrolysis takes a minimum of about 52 kWh of electricity to make a kilogram of hydrogen, according to Boardman. Using a PEMbased approach cuts that figure to around 45 kWh per kg. (The energy content of 1 kg of hydrogen is around 33 kWh.) In contrast, using high temperature steam reduces the amount of electricity required substantially. “With high temperature steam electrolysis, the amount of electricity used can be reduced to around 35 kWh per kg—and even lower than that by providing high temperature heat to the electrolysis cell to compensate for the endothermic splitting of H2O. With heat recuperation and cell heating, it could be possible to reduce the electricity used down to 30 kWh,” Boardman said. The roughly 30 percent increased efficiency is critical to lowering the cost of hydrogen produced by electrolysis. Some three quarters of that cost comes from the expense

of the electricity consumed. INL calculations show that at current wholesale prices of electricity around $30 per MWe, high-temperature electrolysis may cut the cost of hydrogen production to less than $2 a kilogram—a DOE goal. Thermodynamics lies behind the efficiency improvement. It takes less energy to convert steam into hydrogen and oxygen because the water is already in a gaseous state. In addition, at a superheated state, the bonds of the oxygen and hydrogen atoms are easier to break. Because the steam is already at a higher state of energy, it requires less electricity to finish splitting the steam molecules. The efficiency of transforming steam energy to electricity in a traditional large nuclear power plant is, at best, about 34 percent, Boardman said. So, avoiding that step and using steam heat in a more direct fashion improves the overall electrolysis system performance significantly.

Automating the risk out of farming

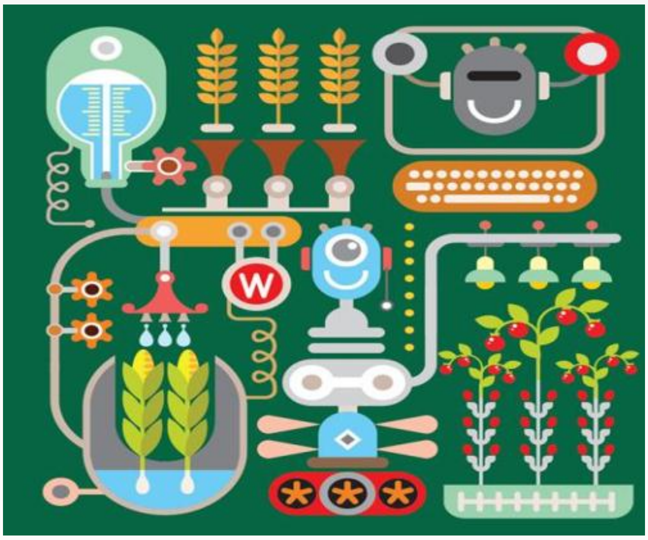
Prof. V. C. Jadhav

THE FARMING AND AGRICULTURE INDUSTRY HAS HAD its fair share of problems over the last decade. According to the online magazine, Successful Farming, some of the top issues poised to affect American farmers in 2020 were food waste, labor shortages, the trade war with China, escalating climate change disasters, and even the impeachment of President Trump. Then COVID-19 descended upon the world. The pandemic of the novel coronavirus exposed systemic problems within several industries. Manufacturing and shipping plants could not maintain the social distancing guidelines or provide the necessary amount of personal protective equipment to protect their workers. Transportation systems shut down services to determine how to clean and disinfect trains and buses properly. Hospitals could not keep pace with the number of people becoming infected, and the medical industry could not manufacturer enough test kits, ventilators, and protective equipment to treat the increasing number of patients. The problems besetting the farming systems did not disappear; instead, they were heightened. Bottlenecks in the supply chain and the lack of risk management and flexibility led to increasing food waste, and the labor shortage that existed before has only gotten worse with COVID-19. In response, the industry has turned to automation as a solution. “There was already a trend for automation and mechanization before the pandemic, and the extra labor shortage risks due to COVID-19 will accelerate automation adoption,” said Arzum Akkas, a professor of operations and technology management at Boston University and an expert in food supply chain management. Several new technology areas, which were already starting to build up steam before COVID-19, have accelerated on to the scene and have taken center stage. “Automation can assist the farming industry in three ways,” Akkas said. “The first is in reducing labor costs substantially. Second, you are faster and can generate more output for a given period of time, meaning a reduction in cost per unit. And the third component is mitigating risk. COVID-19 has created and will continue to be a risk problem with regards to the availability of labor. By switching to automation, you are controlling that risk.”

Automating the risk out of farming

Prof. V. C. Jadhav

Problems Impacting the Farming Industry



"The U.S. supply chain is fragmented, one for grocery stores and the other for food services like restaurants. Such specialization makes operations efficient. Products from the farms are either packaged into a larger box size for food services, or barcoded and labeled for smaller size retail boxes," Akkas said. As the pandemic hit, consumers ran to the store in droves, buying several items in bulk, and leaving stores with little to no supplies. At the same time, the sudden closure of restaurants meant that large bulk orders of items such as flour, poultry, and vegetables had nowhere to go. "When restaurants closed, all the orders coming from the restaurants to the processing plants dedicated to food service stopped, and we had an accumulation of inventory in the farms. The packaging facilities dedicated to the grocery chain, did not have the capacity or capability to process this food, and that's why we saw massive food waste happening on the farm side," Akkas said. Food waste is one of the significant problems plaguing the farming industry. The U.S. Department of Agriculture estimates every year people throw out 40 million tons of food, resulting in a $161 billion loss. With the COVID-19 pandemic, it only got worse. According to an April 9 article in the Guardian, one Florida farmer had to plow 5 million to 6 million pounds of vegetables back into his field due to lack of buyers. The total economic impact for the farm industry could be a $1.32 billion loss from March to May, according to a National Sustainable Agriculture Coalition report. Labor shortages have also hobbled the ag sector. The reduction in the number of immigrant laborers due to their uncertain legal status has not been made up by new domestic workers. "During the last recession from 2007 to 2009, farmers in North Carolina tried hiring domestic laborers. There were 6,500 job openings. Only 163 people showed up, and only seven of them kept their jobs," Akkas said. "The Georgia Fruit and Vegetable Growers Association estimated labor shortages for harvesting and packing cost the state 140 million in crop losses, about 25 percent of the total production value for those crops.

Automating the risk out of farming

Prof. V. C. Jadhav

About 73 percent of the farm labor force is foreign-born, Akkas said. These laborers are seasonal, and half of them come on H2A visas, while the other half are undocumented. According to a May 29 article in Insurance Journal, as many as 2.7 million people in the U.S. are hired as farmworkers each year, including migrant, seasonal, year-round, and guest-program workers as reported by the Migrant Clinicians Network. The increase in COVID-19 cases has significantly impacted the labor force. In the meatpacking industry, where many workers find themselves in confined spaces, 50 percent of the workforce had positive cases. The federal government has tried to maintain a steady flow of migrant workers, waiving interview requirements and exempting them from the temporary immigration ban. They are not protected from infection, however. Members of Congress have requested a coronavirus relief package, which includes funding dedicated to combating the spread of the virus among farmworkers. Over the summer months, the impact on produce farming in particular was expected to be visible. To handle these risks as the ag industry moves forward, automation can be introduced to create flexibility and help reduce the reliance of an unstable workforce.

Greenhouse Farming

All-Year Round According to AgFunder's 2020 Farm Tech Investing Report, farm tech startups raised $4.7 billion in 2019. Novel farming startups, such as automated greenhouses, raised $945 million venture capital in 2019, a 37 percent increase in funding yearover-year. One of those startups is Iron Ox. In 2019, it received $20 million in venture capital for its indoor robotic greenhouse farming system. "Iron Ox's primary goal and mission is to help address food security, to feed an ever-growing global population, by taking robotics, artificial intelligence, and plant science-first approach to farming," said CEO and cofounder Brandon Alexander .

Automating the risk out of farming

Prof. V. C. Jadhav

Iron Ox's system is an automated greenhouse that can grow over 50 varieties of leafy greens and vegetables hydroponically all-year-round. Its custom robots manage all aspects of the growing operation. A robot moves hydroponic modules from the grow area to production areas for harvest and transplantation. Those harvesting and transplanting activities are aided by a large robotic arm that does the more delicate tasks. Iron Ox has designed the greenhouse growing system around the sun to use less energy than other modern forms of farming. The hydroponic growing system uses one-tenth the water of traditional farming while producing yields 30 times greater. "In general, robots can be pretty finicky. They like structured environments more than unstructured spaces that can create unpredictable situations," Alexander said. "We took a step back and evaluated the entire growing process and developed a growing process that takes a robotics-first approach. Essentially, we realized we could make a huge impact by redesigning the growing process from the ground up with robotics and artificial intelligence at the core." Artificial intelligence is a core component of how Iron Ox's robotics navigate about the greenhouse to transplant and harvest plants, including how they provide the plants' nutrients. The AI helps to understand their crops' health and feed those learnings back into the system to grow better produce and provide a more reliable and closer farming network. "Much of the produce that people have access to has traveled almost 2,000 miles before it reaches the grocery store shelf. There's bound to be food waste when food has to travel that far," Alexander said. "If we can place our farms closer to major population centers and provide fresher produce to our customers, we can cut down on supply chain complexity." "The grocery supply chain has had a hard time finding truck drivers during the COVID-19 pandemic," said Akkas. "Finding people to load and drive the trucks was one of the bottlenecks in the grocery supply chain. When you have goods coming from farther locations and you have a labor shortage problem, then local farms are less risky." Local automated greenhouse farms can develop systems to handle the entire growing process, from seed to packaging, closer to major population areas, and flexible enough to handle disruptions. "Automation offers an endless set of be picked and moved from the growing area to the harvesting area. co-founder of Root A.I

Automating the risk out of farming

Prof. V. C. Jadhav

Root A.I. was established in 2018 with a mission to reinvent the food supply chain to ensure people have continuous access to food. “Over 70 percent of the tomatoes you buy from major retailers come from greenhouse farms,” Lessing said. “Farmers are building up greenhouse facilities now on the east coast of the U.S. because people want access to this food year-round and less dependence on imported goods during the off-season.” Root A.I.’s primary technology is the automated picking of delicate fruits. It has only been recently, according to Lessing, that AI neural networks and off-the-shelf sensing technology have become widespread and affordable enough to tackle that challenge. “The human hand does remarkable things, and we asked ourselves what are the salient features of human dexterity that are leveraged the most when picking fruits,” said Lessing. “Instead of building a 'Terminator hand' with tons of joints and sensors and extensive programming for a complex grip, we took a simpler approach. We perfected an elegantly simple mechanism, through its structure and motion, gets that perfect pick by design.” Their robotic harvesting technology Virgo was based-on the human body. It grips the produce and uses an embedding and twisting motion, so the robotic fingers and the wrist mimic the human hand. The gripper, manipulator, and vision system travels on an autonomous mobile platform that can drive through a farm and harvest different kinds of perishable items. It picks and maintains the produce by using advanced AI and vision systems. Root A.I.’s proprietary vision hardware combined with the company’s custom convolutional neural networks measures properties of the fruit like ripeness, size, and quality grading. All of this is done in the robot in realtime, without relying on remote access to a datacenter. Since COVID-19, Root A.I. has accelerated its summer launch across a series of customers in the U.S. and Canada. These initial customers will receive multiple copies of their robotic units and will have full harvesting service set up at their facilities. “Automation in the food industry has already existed but now needs to happen in orders of greater magnitude,” Lessing said. “For those who haven’t adopted automation, pulling out of this crisis, are going to be faced with a lot of questions about how to adopt modern-age farming technology.”

Automating the risk out of farming

Prof. V. C. Jadhav

Au**Automation for Smarter Dairy Farming**

tomation is not only limited to produce farming. Lely was founded in the Netherlands and, for over 70 years, has introduced new mechanized methods to help eliminate redundant processes or labor requirements on the farm, particularly in dairy farming. “If you look at the robotic farming systems over the last 10 to 12 years, it follows our vision of automating redundant manual tasks on the farm,” said Chad Huyser, regional director and North America president of Lely International. Lely’s automatic dairy milking process uses automation and artificial intelligence for cows to feed and milk themselves. The Astronaut-5 is a milking unit in which cows can freely walk into when they need to be milked. The unit identifies the cow via the animal’s tags and tracks the cows’ feeding .

Automating the risk out of farming

Prof. V. C. Jadhav

ration and lactation cycle. Overall, Lely collects more than 120 data points per animal each milking. For a herd of 100 cows, that amounts to more than 10,000 data points each day. When a cow walks into the milking unit, a laser-ranging system performs a 3D scan to locate the optimal position to attach the milking unit to the udder. The mechatronics and kinematic systems, supplied by Festo, the motion control supplier for the unit, move it into position. The whole process takes five to six minutes. According to Huyser, within three weeks, about 85 to 90 percent of the cows start to understand the automated process naturally. The cows' feed intake significantly drives the milking process, and Lely is using data analytics to maximize the cows' feed intake and achieve high product yield. Using this system, farmers can see a 10 to 15 percent increase in milk production. "If you were to ask a dairy producer today, their single biggest risk is not having enough labor to milk the cows," Huyser said. "Since labor is one of the main drivers in controlling price, you start to look at ways to mitigate labor risk and how to move your operation forward." The COVID-19 pandemic has given dairy farmers a frontrow seat to what real volatility can look like in a commodity market. In the case of dairy production, automation technology can dramatically help them change their supply side. If dairy farmers had greater control of their supply chain during the early height of the pandemic, they could have restructured their cow milking schedule in response to the demand.

"Since cows are traditionally managed as a herd, you don't have individual cow data in most respects of their milking and feeding. Today, because of the way we can manage the individual cow data, the farmer can now look at individual animals, at their genetic potential and their milk production, and start to make smarter decisions," said Huyser. "With COVID-19 and everything as it relates to the labor situation, large-scale producers have seen a decrease of least 25 to 30 percent in their workforce. Dairy producers need more flexibility built into their operation."

Automating the risk out of farming

Prof. V. C. Jadhav

With automation and data analytics systems, dairy producers can establish some fixed costs and decision-making power on how to scale their supply chain in response to drastic changes in the market. Ultimately, automation in agriculture can provide greater and smarter control to the farmers. In a world struggling to feed many, especially during natural disasters and pandemics, the ability to produce sustainable food for all is crucial. "The core of what we do is to is to further the cause of agriculture and solve the challenging problems the world will face in the coming years," Huyser said. "I don't think there's a more exciting time to be part agriculture than right now and be part of something bigger than yourself. We are trying to help feed the world, and regardless of whatever role you might play in agriculture, that's a noble endeavor."

https://doi.org/10.1115/1.2020-AUG1

Student Articles

Industry 4.0

Mr. Chaitanya Thakur, BE

We're in the midst of a significant transformation regarding the way we produce products thanks to the digitization of manufacturing. This transition is so compelling that it is being called Industry 4.0 to represent the fourth revolution that has occurred in manufacturing. From the first industrial revolution (mechanization through water and steam power) to the mass production and assembly lines using electricity in the second, the fourth industrial revolution will take what was started in the third with the adoption of computers and automation and enhance it with smart and autonomous systems fueled by data and machine learning. Even though some dismiss Industry 4.0 as merely a marketing buzzword, shifts are happening in manufacturing that deserves our attention.

Industry 4.0

Mr. Chaitanya Thakur, BE

Industry 4.0 optimizes the computerization of Industry 3.0

When computers were introduced in Industry 3.0, it was disruptive thanks to the addition of an entirely new technology. Now, and into the future as Industry 4.0 unfolds, computers are connected and communicate with one another to ultimately make decisions without human involvement. A combination of cyber-physical systems, the Internet of Things and the Internet of Systems make Industry 4.0 possible and the smart factory a reality. As a result of the support of smart machines that keep getting smarter as they get access to more data, our factories will become more efficient and productive and less wasteful. Ultimately, it's the network of these machines that are digitally connected with one another and create and share information that results in the true power of Industry 4.0.

Industry 4.0 applications today

While many organizations might still be in denial about how Industry 4.0 could impact their business or struggling to find the talent or knowledge to know how to best adopt it for their unique use cases, several others are implementing changes today and preparing for a future where smart machines improve their business. Here are just a few of the possible applications:

Identify opportunities: Since connected machines collect a tremendous volume of data that can inform maintenance, performance and other issues, as well as analyze that data to identify patterns and insights that would be impossible for a human to do in a reasonable timeframe, Industry 4.0 offers the opportunity for manufacturers to optimize their operations quickly and efficiently by knowing what needs attention. By using the data from sensors in its equipment, an African gold mine identified a problem with the oxygen levels during leaching. Once fixed, they were able to increase their yield by 3.7%, which saved them $20 million annually.

Optimize logistics and supply chains: A connected supply chain can adjust and accommodate when new information is presented. If a weather delay ties up a shipment, a connected system can proactively adjust to that reality and modify manufacturing priorities.

Robots: Once only possible for large enterprises with equally large budgets, robotics are now more affordable and available to organizations of every size. From picking products at a warehouse to getting them ready to ship, autonomous robots can quickly and safely support manufacturers. Robots move goods around Amazon warehouses and also reduce costs and allow better use of floor space for the online retailer

Industry 4.0

Mr. Chaitanya Thakur, BE

Additive manufacturing (3D printing): This technology has improved tremendously in the last decade and has progressed from primarily being used for prototyping to actual production. Advances in the use of metal additive manufacturing have opened up a lot of possibilities for production.

Internet of Things and the cloud: A key component of Industry 4.0 is the Internet of Things that is characterized by connected devices. Not only does this help internal operations, but through the use of the cloud environment where data is stored, equipment and operations can be optimized by leveraging the insights of others using the same equipment or to allow smaller enterprises access to technology they wouldn't be able to on their own.

Autonomous equipment and vehicles: There are shipping yards that are leveraging autonomous cranes and trucks to streamline operations as they accept shipping containers from the ships.

While Industry 4.0 is still evolving and we might not have the complete picture until we look back 30 years from now, companies who are adopting the technologies realize Industry 4.0's potential. These same companies are also grappling with how to upskill their current workforce to take on new work responsibilities made possible by Internet 4.0 and to recruit new employees with the right skills.

Green Technology

Miss. Nawale Payal, BE

Green technology, also known as sustainable technology, takes into account the long- and short-term impact something has on the environment. There are numerous examples of green technology and what goes into the making of a green product or technology, such as energy efficiency, recycling, health and safety concerns, renewable resources, and more.
Green technology offers us the best hope to reverse the effects of climate change and pollution. In this article we will introduce some new technological innovations that transform the energy sector. These technologies allow for the captivation of clean energy from natural resources such as water and sun, and have great potential to revolutionize the energy market towards sustainability.

1. **Water Purification**

There is an excessive and wasteful use of clean water. The Earth naturally recycles its water, but new technologies help to speed up the process.
According to the Washington State Department of Health, our groundwater and surface water supplies are at risk of overuse in many areas. The demand can be greater than the amount supplied by rain and snowmelt.
The United Nations water agency (UN Water) estimates that more than 80 percent of the wastewater generated by society flows back into the ecosystem without being treated or reused.
In this field, there are still only a few technological developments, but the existing ones are important.
Key developments include membrane filtration, microbial fuel cells, nanotechnology, development of biological treatments and natural treatment systems such as wetlands. All of the named processes are used to make water more drinkable or significantly reduce the presence of pollutants from what is discharged into the sea and rivers.

2. Recycling and waste management

New advancements in green technology are designed to help manage and recycle waste material.

Green Technology

Miss. Nawale Payal, BE

A new technology used by the Danish company Ørsted allows for unsorted household waste to be divided up into plastic fractions that can be used for recycling, and a plastic to textile fraction that can be used for fuel or for recycling. The main product, however, is a liquid where all the nutrients from the waste have been dissolved. They then convert this into a form of liquid that can be used to make biogas.

Other new recycling technologies aim to help solve the plastic waste problem. Chemical recycling, for example, is an innovative process that uses chemicals to break down post-consumer plastic waste into its valuable chemical components. These components can then be used as fuel or converted once again into new plastic products.

3. Self-sufficient buildings

Self-sufficient buildings are buildings designed to be operated independently from infrastructural support services such as the electric power grid, gas grid, and municipal water systems.

Solar panels, for example, are designed to capture energy from the sun, but the majority of the sun's energy is lost as heat. New inventions in solar panel design allow for the production of both electricity and heat. These solar panels help buildings produce their own heat and electricity through solar energy.

The front of these panels is designed to generate photovoltaic energy while the rear produces hot water by means of a heat exchanger. This provides households with free hot water that has been sourced in an environmentally friendly manner.

4. Generation of energy from the waves

The energy from waves, tides and currents, known collectively as ocean energy, is a massive resource. The total energy available along the American continental shelf could potentially provide roughly half of the total US supply.

An Australian company has been working on a system that uses underwater buoys to convert sea waves into zero emission energy and desalinated water. The steel-made buoys, which can currently generate 240 kilowatts, are the main part of the system. The buoys are less susceptible to extreme weather damage while underwater waves are sufficient to generate power.

Green Technology

Miss. Nawale Payal, BE

The buoys' pumps drive the high-pressure water to an onshore power plant. The high-pressure water spins the turbines which then generates zero carbon electricity. The system can also be used to power a desalination plant. The company believes that the price for the electricity from the water will be competitive with diesel if it is deployed at a large scale.
Another promising technology in this sector is tidal energy. It has huge potential in the renewable energy market because of its predictable and consistent availability.

5. Vehicles that do not emit gases
One of the greatest environmental polluters is the automotive industry, but many people worldwide depend on their cars. It is estimated that there are currently around two billion cars on the road, and within 20 years this number is predicted to double as a consequence of rapid growth in India and China. In the automotive industry, alternative fuel vehicles, also called green vehicles, have been introduced as an alternative that is less harmful to the environment.

6. Harnessing solar energy
Solar energy is the most abundant energy on earth and solar power is on the rise. While solar plants have become common in many households, the technology is still constantly improving.
Scientists have been able to overcome a design flaw of solar panels by allowing them to collect energy in both the rain and sun. These so-called all-weather solar panels allow any homes, no matter the geographical location, to produce electricity for their home. During rainfall the solar panel generates electricity from the force of the rain falling on their surface.

7. Vertical gardens and farms
Vertical Farming is an eco-friendly technology that has the potential to solve our food production problems. The concept is to grow produce in stacked vertical layers rather than horizontally.

Green Technology

Miss. Nawale Payal, BE

The benefit of vertical farming is increased sustainability. Some vertical farms don't even require soil, and reduce water use exponentially. The technology allows us to build vertical farms in buildings around cities and provides people with fresh and nutritious food. The newest inventions in vertical farming, such as an intelligent root misting system for indoor produce, allows vertical farms to use 95% less water than a regular field.
Vertical farms have the potential to feed overpopulated cities while using less land and less water. They also cut greenhouse gas emissions by eliminating the need to transport the produce over long distances. Over the past few years, vertical farms have sprouted all over the world including places like Vancouver, Panama, Singapore, and cities in the UK and the U.S.
Investments in technology are necessary to advance green energy solutions and make the much-needed transition towards a sustainable energy infrastructure. Maximizing consumer and economic benefits while simultaneously minimizing energy losses and environmental impact is essential to protect the health of the world for not only the present but also future generation.

With all their promise, the advances mentioned above are just the tip of the technological iceberg. Many companies are coming to the realization that change has to happen and it has to happen soon. As our resources dwindle and are surpassed by demand, we work to find those examples of green technology that make an impact, and the people who want their investments to make an impact.

Digital Manufacturing

Mr. Tushar Kumbharde, BE

What is Digital Manufacturing?

Digital manufacturing is the application of computer systems to manufacturing services, supply chains, products and processes. Digital manufacturing technologies link systems and processes across all areas of production to create an integrated approach to manufacturing, from design to production and on to the servicing of the final products.

By modelling and simulating processes it is possible to improve the quality of manufacturing decision making, while improving the processes to create cost savings, reduce time to market, and create a joined up manufacturing process that unites digital tools with the physical execution of manufacturing.

By using a process that is centred around a computer, manufacturers can create a digital thread through the manufacturing process to analyse data across the product lifecycle and create actionable processes. Digital manufacturing systems also allow for customer data to be sent to product managers in order to anticipate demand and any ongoing maintenance requirements to deliver products via manufacturing that is centred on customer needs.

Digital Manufacturing

Mr. Tushar Kumbharde, BE

The Three Aspects of Digital Manufacturing

It can be broken down into three main areas; product life cycle, smart factory, and value chain management.

Each of these relates to a different aspect of manufacturing execution, from design and product innovation to the enhancement of production lines and the optimisation of resources for better products and customer satisfaction.

The product life cycle begins with engineering design before moving on to encompass sourcing, production and service life. Each step uses digital data to allow for revisions to design specifications during the manufacturing process.

The smart factory involves the use of smart machines, sensors and tooling to provide real time feedback about the processes and manufacturing technology. By uniting operations technology and information technology, this digital transformation allows for greater visibility of factory processes, control, and optimisation to improve performance.

The value chain management focuses on reducing resources to create an optimal process with decreased inventories while maintaining product quality and customer satisfaction.

What are the Advantages of Digital Manufacturing?

There are a number of benefits by uniting manufacturing processes across different departments while reducing the potential for errors by creating an automated exchange of data.

Increased efficiency is accomplished by a **joined-up manufacturing process which eliminates errors** due to lost or misinterpreted data which is common for paper-based processes.

With a **quicker turnaround across all levels of the value chain**, digital manufacturing offers reduced costs, while allowing for design changes to be implemented in real time and also lowering maintenance costs.

The **real-time manufacturing visibility** afforded by digital technologies provides improved insights for critical decisions and a faster pace of innovation.

Furthermore, it allows an entire manufacturing process to be created virtually so that **designers can test the process before investing time and money** into the physical implementation.

Digital Manufacturing

Mr. Nlilesh Kumbharde, BE

Cloud-based manufacturing can be used for this modelling, taking open access information from a number of sources to develop reconfigurable production lines and thereby improve efficiency.

Design

Alongside the optimisation of processes, digital manufacture delivers a number of advantages for design too. These design advantages begin with the use of 3D modelling software to design tools and machinery as well as factory floor layouts and production flows.

Through the simulation of a manufacturing process it is possible to find methods to improve a process inexpensively and quickly before production even begins.

Even when manufacturing has started it is possible to monitor systems to assess any deviations or problems with production so they can be addressed quickly.

As well as optimising processes, digital technology can be used to make fast changes to product designs while assessing their suitability. This process can be achieved via cloud-based design.

Industrial Use

Digital manufacturing has spread rapidly through industries such as aerospace and defence. This allows for the integration of supply networks through cloud computing to allows suppliers to collaborate effectively.

Digital manufacturing technology is also perfectly aligned for incorporation into automated processes such as additive manufacturing, laminated object manufacturing, and CNC cutting, milling, and lathing.

What is the Future of Digital Manufacturing?

Digital manufacturing looks set to continue and grow in the future as the use of information for production processes becomes increasingly automated.

With systems that are able to interact with each other, the growth of Industry 4.0 looks set to continue the trend for joined-up production in order to increase competition and improve and streamline processes.

JSW steel plant

PRODUCTS

- **Flat Products**
- **Hot Rolled (HR)**
- **Cold Rolled (CR)**
- **Color Coated Products**
- **JSW Pragati**
- **JSW Colouron**
- **JSW Colouron+**
- **Galvanised**
- **JSW Vishwas**
- **GALVECO**
- **Galvalume**
- **JSW Vishwas+**
- **GALVOS**
- **Long Products**
- **TMT Bars**
- **Neosteel Bars**
- **Wire Rods**
- **Special Alloy Steel**

ACHIEVEMENTS

ACHIEVEMENTS

'Smart Sugar Cane Planter' Project Team **'Agro-Abhiyantas'** winner of **SIH-2020** with **1 lac** cash prize. Event Organized by Ministry of HRD Government of India.

ACHIEVEMENTS

Team Spartans [Chaitanya Thakur & Team] successfully completing "Camber Bike" (*A Jogging Trike*)

#Key_Features:
Unique sport:
The upright body position allows for better breathing and great cardio.Camberbike trains your balance and reflexes in a very intuitive way - the result is a full-body low-impact workout.
Ultra compact:Camberbike can follow you anywhere, it is light, compact and foldable. It fits in the tiniest trunks and lockers, plus you can easily take it onboard public transport.

ACHIEVEMENTS

EFFI-CYCLE 2020

>>> DRIVE THE FUTURE<<<

E-MOBILITY SEASON

SAEINDIA NORTHERN SECTION

AWARD CERTIFICATE

This is to certify that the award for Overall 1st Runner Up of Efficycle 2020 is presented to Team THE AVENGERS (Team ID 20033) from SNJB'S LATE SAU KANTABAI BHAVARLALJI JAIN COLLEGE OF ENGINEERING, NASHIK, Maharashtra in SAE Northern India Section EFFI-CYCLE 2020 hosted virtually from 17th to 27th September, 2020.

Shri Deepak Panda
Convener, Efficycle-2020

CONVENTIONAL HYBRID

Shri Dinesh Tyagi
Chairman, SAE-NIS

SUPPORTED BY

MARUTI SUZUKI

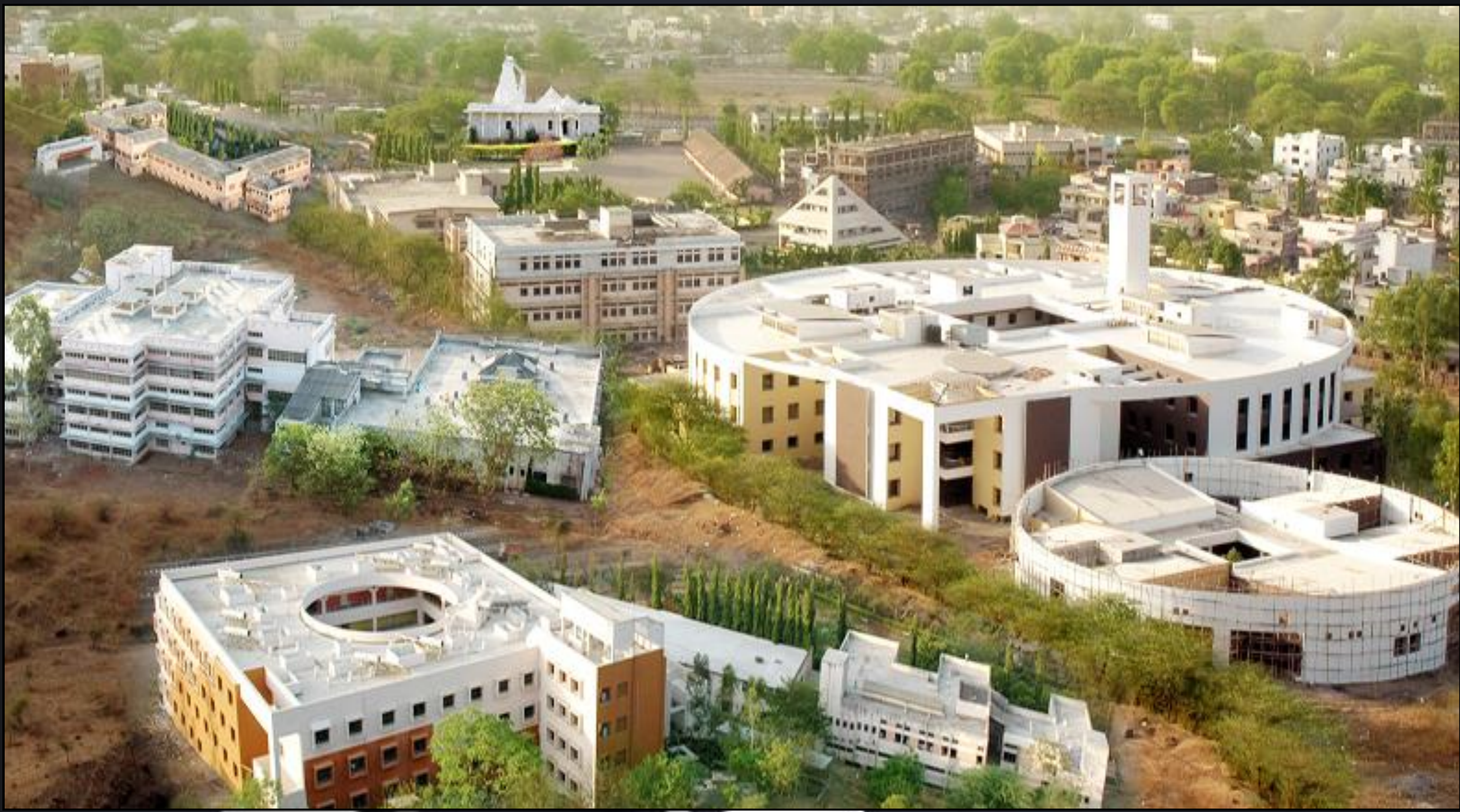
iCAT

Certificate No: EFFI2020/V/0008
Date of Issue: 4-Oct-2020

Team Avengers won 3 Trophies in National E-Mobility Event "EFFICYCLE-2020" organised by Society of Automotive engineers [SAE]

- **All India Rank - 2 (₹ .10,000/-)**
- **CAE Winner (10,000/-)**
- **Business Plan & Cost winner (₹ .5000/-)**

SNJB's Late Sau K.B Jain College of Engineering



Steering Committee

Shri. Dinesh Lodha
(Vice Chairman , Trust Board)

Shri. Zumbarlal Bhandari
(Joint Hon. Secretary , Prabandh Samiti)

Shri. Sunil Chopda
(Member , Prabandh Samiti)

Dr.Mahadeo D. Kokate
(Principal, College of Engineering)

Chief Editor:

Dr. S.D. Sancheti
(HOD Mechanical)

Editor (i/c)

Mr. D. S. Suryawanshi
(Assistant Professor)

Student Editor:

Mr. Chaitanya Thakur
(BE Mechanical)

Student Co-editor:

Mr. Bhambar Shubham
(TE Mechanical)

Address

SNJB's

Late.Sau K.B. Jain

College of Engineering

Department of Mechanical Engineering

Neminagar, Chandwad 423101

Website: www.snjb.org

Email: hodmechcoe@snjb.org