KSIT
K S INSTITUTE OF TECHNOLOGY

EMANATION

MECHANICAL DEPARTMENT NEWSLETTER

Vol - 5

ROBOTICS & ARTIFICIAL INTELLIGENCE

#ROBOTIC SURGERY

Robotic surgery, computer-assisted surgery, and robotically-assisted surgery are terms for technological developments that use robotic systems to aid in surgical procedures.

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#SPIDER ROBOT

Can Spiders walk and climb on different terrain types and uneven grounds with their eight legs?

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#PROCESS AUTOMATION

Are robots capable of building a car?

>>Page 9

#HUMANOID ROBOTS

A humanoid robot is a robot with its body shape built to resemble that of the human body.

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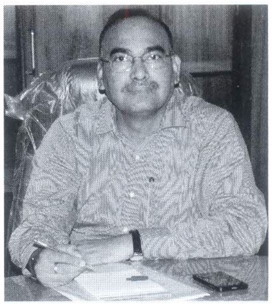
Sri Y Ramachandra Naidu
President

Sri K Venkatesh Naidu
Secretary



Sri D Rukmangada
Treasurer

We are very pleased to know that the Mechanical department is launching its Fifth edition of newsletter Emanation. At the outset, we congratulate the department and specially the newsletter committee for their efforts in bringing out the newsletter. The newsletter is an amalgamation of all the events held in the department and it plays an instrumental role in providing a great exposure of all the achievements accomplished by the student's and the faculty.

GOOD LUCK

Making a difference. As we have said in these pages, KSIT - Emanation is on a roll. Engineers turn ideas into reality; they question, explore, invent, discover, and create. Our increasing recognition is evident by the enormous success of our staff and students effort in contributing their rich service in several structures. The KSIT - Emanation is expressing in its own way, the hidden talents of young minds. The contents in this newsletter definitely highlight the exciting activities of staff and students in all domains of engineering. I personally thank everyone for their effort in bringing out the fifth volume of **EMANATION** which contains useful information and also look forward to hear from all readers, who would like to share with us.

Dr. T. V Govindaraju
Principal / Director

Team Emanation is progressing. It has given a platform for the staff and students to express their view and exhibit their hidden talents. I thank all those who have put their efforts to bring out the fifth edition of their newsletter of theme ROBOTS and AI. I wish the contributions and the efforts grow in future also.

Dr. P. M. Suresh
Professor and Head
Mechanical Engg

Thought from Editors

Greetings and a warm welcome to our Fifth edition of 'EMANATION'. Emanation began as a dream back in March 2014 and since then each edition has emerged as a new dimension at the college level through publishing various articles, photos and information. We have tried our best to include content that would appeal to all sections of people and we will continue to do the same. This edition is about robotics. And this has been divided into several sections namely andro-humanoid, process automation, humanoid robots, robotic surgery and many more.

While there is an aim to provide updated information that invokes and inspires, a quality that is central to 'EMANATION', it is just not about the words, it is imagery and spacing between that enhances the exchange, where content can be felt as well as understood.

As a team, we would also like to acknowledge the contribution of everyone who made these issues possible. We hope you have a nice time reading the same.

- Team Emanation

"Time is a drug. Too much of it kills you"

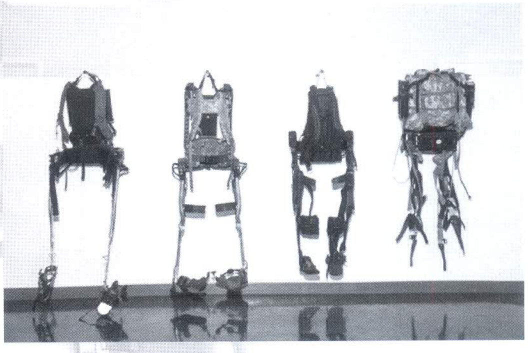
INTRODUCTION

Ever dreamed of a robot that cleaned your house, washed your car or walked the dog? People would call you a mentally retarded guy if you voiced your opinion however that is not the case today. Rapid developments have made robotic technology professions among the most exciting available to recent graduates Positions within the robotics industry generally are the different stages of the engineering process. Some engineers, for example, are responsible for the planning as to how robotics might address a problem make the process more efficient. Others apply the available engineering principles towards making of the real Robot. The robotics industry also employs a whole platoon of support staff, like testers, programmers and operators. While positions vary, some skills can be called a must for the people working in the industry.

EXOSKELETON

Mechanical outfits, known as exoskeletons, are gaining a foothold in the real world. The Japanese company Panasonic announced recently that it will start selling an exoskeleton designed to help workers lift and carry objects more easily and with less risk of injury. The suit was developed in collaboration with a subsidiary company called ActiveLink. It weighs just over 13 pounds and attaches to the back, thighs, and feet, enabling the wearer to carry 33 pounds of extra load. The device has been tested by warehouse handlers in Osaka, Japan, and is currently in trials with forestry workers in the region.

The Soft Exosuit is attached with a network of fabric straps, but that's only the beginning. Researchers had to carefully study the way people walk and determine which muscles would benefit from the added forces offered by the Soft Exosuit. With a better understanding of the biomechanics involved, the team decided to go with a network of cables to transmit forces to the joints. Batteries and motors are mounted at the waist to avoid having any rigid components interfering with natural joint movement. The wearer doesn't have to manually control how the forces are applied, or stick to a certain pace when walking with the Soft Exosuit activated. The machine is supposed to work with the wearer, not the other way around, remember? The designers integrated a network of strain sensors throughout the straps that transmit data back to the on-board microcomputer to interpret and apply supportive force with the cables.



Panasonic's device is among a small but growing number of exoskeletons available commercially less fantastic and more cumbersome versions of a technology that's been a staple of science fiction for some time. Though they have mainly been tested in medical and military settings, the technology is starting to move beyond these use niches, and it could make a difference for many manual labourers, especially as the workforce ages.

Unlike the traditional exoskeleton concept, Harvard's so-called "Soft Exosuit" is not designed to give the wearer vastly increase lifting capacity. Instead, the Soft Exosuit works with the musculature to reduce injuries, improve stamina, and enhance balance even for those with weakened muscles. In some ways, this approach to wearable robotics is the opposite of past exoskeletons. Rather than the human working within the abilities and constraints of the exoskeleton, the exoskeleton works with the natural movements of the human wearer. It was actually harder than you might expect to design a wearable machine that didn't get in the way.

Exoskeletons could also be applied in the area of rehabilitation of stroke or Spinal cord injury patients. Such exoskeletons are sometimes also called Step Rehabilitation Robots. An exo-skeleton could reduce the number of therapists needed by allowing even the most impaired patient to be trained by one therapist, whereas several are currently needed. Also training could be more uniform, easier to analyze retrospectively and can be specifically customized for each patient. At this time there are several projects designing training aids for rehabilitation centers.

DID YOU KNOW ?

"The first working robot made cars as part of production line at car giant, Ford, back in 1961."

"Success is how high you bounce when you hit bottom"

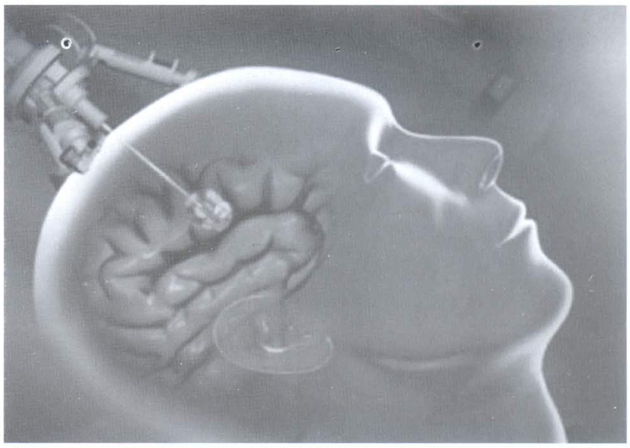
ROBOTIC SURGERY

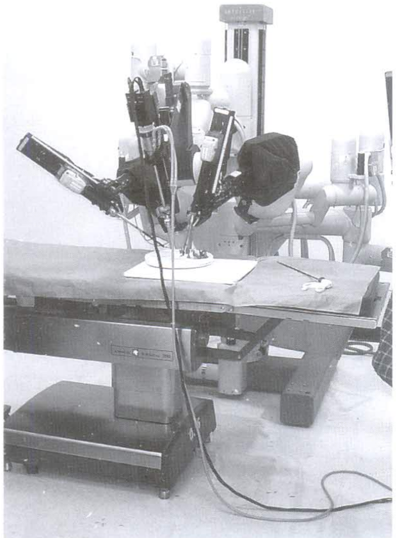
The first robot to assist in surgery was the Arthrobot, which was developed and used for the first time in Vancouver in 1983. Robotic surgery is similar to laparoscopic surgery. It can be performed through smaller cuts than open surgery. The small, precise movements that are possible with this type of surgery give it some advantages over standard endoscopic techniques.

The surgeon can make small, precise movements using this method. This can allow the surgeon to do a procedure through a small cut that once could be done only with open surgery.

Once the robotic arm is placed in the abdomen, it is easier for the surgeon to use the surgical tools than with laparoscopic surgery through an endoscope.

The surgeon can also see the area where the surgery is performed more easily. This method lets the surgeon move in a more comfortable way, as well.





Transplant surgery (organ transplantation) has been considered as highly technically demanding and virtually unobtainable by means of conventional laparoscopy. For many years, transplant patients were unable to benefit from the advantages of minimally invasive surgery. The development of robotic technology and its associated high resolution capabilities, three dimensional visual system, wrist type motion and fine instruments, gave opportunity for highly complex procedures to be completed in a minimally invasive fashion. Subsequently, the first fully robotic kidney transplantations were performed in the late 2000s. After the procedure was proven to be feasible and safe, the main emerging challenge was to determine which patients would benefit most from this robotic technique. As a result, recognition of the increasing prevalence of obesity amongst patients with kidney failure on hemodialysis posed a significant problem. Due to the abundantly higher risk of complications after traditional open kidney transplantation, obese patients were frequently denied access to transplantation, which is the premium treatment for end stage kidney disease.

The use of the robotic-assisted approach has allowed kidneys to be transplanted with minimal incisions, which has virtually alleviated wound complications and significantly shortened the recovery period. The University of Illinois Medical Center reported the largest series of 104 robotic-assisted kidney transplants for obese recipients. Amongst this group of patients, no wound infections were observed and the function of transplanted kidneys was excellent. In this way, robotic kidney transplantation could be considered as the biggest advance in surgical technique for this procedure since its creation more than half a century ago.

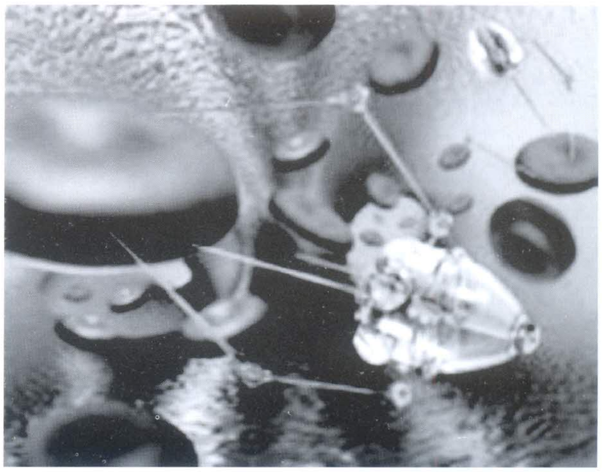
Robotic surgery can take longer to perform. This is due to the amount of time needed to set up the robot. Also, many hospitals may not have access to this method.

NANOROBOTICS IN MEDICINE

The term nano describes a length of measurement equal to one-billionth of one meter which is approximately the width of 10 atoms. The resulting miniature robotic machines may be as small as a few molecules in length or width.

Nanobots also known as nanomedibots, these machines will be able to repair damaged or diseased tissues at the molecular level. The circulatory system is a natural highway for these devices and the nanomedibots will cruise through the blood stream to the area of distress.

They may be used to attach themselves to specific cells, such as cancer cells, and report the position and structure of these tissues.

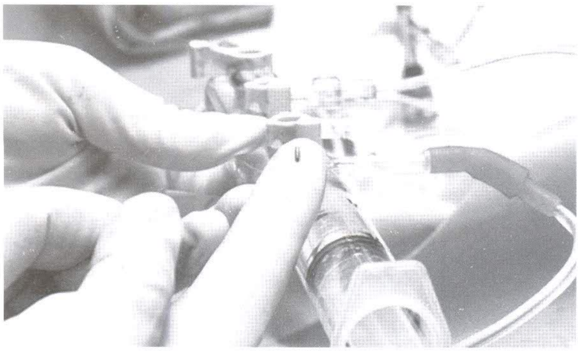


Light in the 700-1000 nanometer range will pass through tissue with minimal absorption. When this near infrared light strikes this particular type of nanomedibot, the device gets hot due to the oscillation of the metal's electrons in response to the light.

Using an MRI to precisely place the nanomedibots in the cancerous region, the light causes the devices to heat to 131 degrees Fahrenheit which destroys the cancerous cells but doesn't damage surrounding tissues.

In cancer treatment, ribonucleic acid interference is a method that attacks cancers on a genetic level. Nanobots laden with interfering RNA that deactivates the protein production of the cancer and kills the malignancy would attach themselves to the tumor and deliver the lethal genetic material.

Nanobots take out every cell in the area they're distributed to, they're able to recognize and interact with specific molecules. This means that new drugs don't even need to be developed; instead, drugs that have already been proven to be effective for cancer treatment but too toxic for regular use can be used in conjunction with nanobots to control said toxicity.

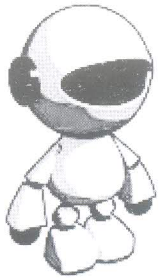


Nanobots are actually made from DNA, specifically a single strand of DNA folded into a desired shape. Nanobots are designed in a clamshell shape, and work as a carrier for existing cancer drugs. Think of them like a protective box. They've been programmed to be in two states—an "off" position, where they're closed tightly so they can bypass healthy cells without causing any damage, and an "on" position, where the clamshell opens up to expose cancerous cells to the drug in question.

"Searching for a safer cancer drug is basically like searching for a gun that kills only bad people."

- TEDMED

DID YOU KNOW ?



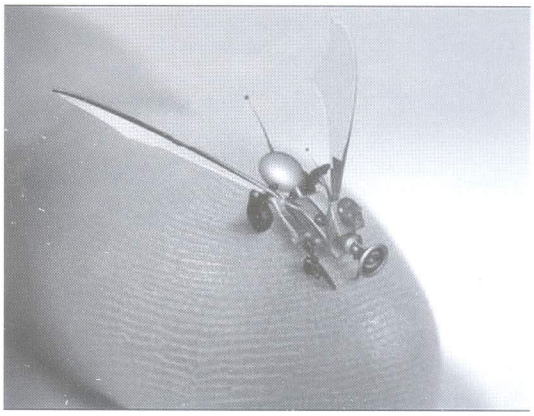
"Robot" comes from the Czech word robota, meaning "drudgery," and first appeared in the 1921 play (Rossum's Universal Robots).

ENGINEERING

Nanotechnology is the name of the branch of engineering concerned with engineering nanobots.

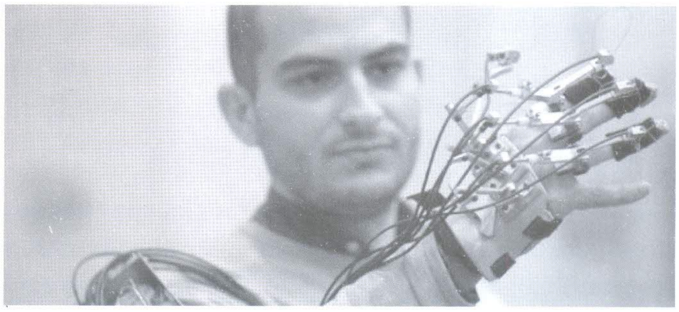
By virtue of the fact that nanorobots may be made from almost any type of material, the manufacturing processes being researched are varied as well. The two principle manufacturing conventions are top down or bottom up.

The former process involves the extreme miniaturization of existing robotic devices while the latter describes a process of building starting at the atomic level and constructing any object one atom at a time.



Specialized nanorobots known as assembler nanobots will be required to create more sophisticated units. Theoretically, the assemblers would use the bottom up approach and stack atoms upon each other in layers to form the desired nanomachine. However these assembler units have yet to be developed. Current technology has employed atomic force microscopes and scanning tunneling microscopes to arrange atoms.

Initially, the microscope is used to precisely locate the particle that will be moved. Then, a higher electron force than is normally used for imaging is targeted on the particle. This needs to be done in a vacuum and at very low temperatures approaching four degrees Kelvin to inhibit electron excitation and spatial uncertainty caused by temperature drift in the room and between the specimen and the probe when using a scanning probe microscope.

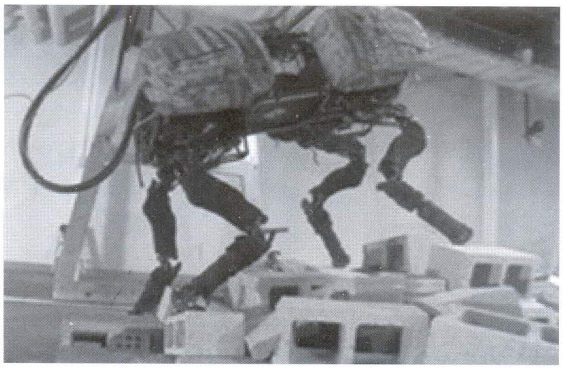


"You gotta be pretty desperate to make it with a robot"

ANDRO HUMANOID

WildCat and BigDog

As their names suggest, WildCat and BigDog are four-legged, headless robots designed to walk, run and carry heavy loads through potentially dangerous terrain, much like deployed troops. DARPA awarded contracts to Boston Dynamics to develop WildCat and BigDog for use by the military.



BigDog, created in 2005, is 3 feet (0.91 meters) long, and stands 2.5 feet (0.76 m) tall. The robot, which is roughly the size of a small mule, is capable of hauling 400 pounds (181 kg) of cargo, and can navigate difficult terrain and inclines up to 35 degrees.
WildCat, however, is quicker and more agile. The robot can gallop up to 16 mph (25 km/h) on flat surfaces, and is part of a DARPA mission to develop robots that can assist human soldiers on a variety of ground missions.

Transformer

Imagine a militarized version of Chitty Chitty Bang Bang. This is the thrust of DARPA's Transformer project, which aims to develop a flying armored car. The four-person vehicle will be able to drive normally but also take to the skies to avoid road obstructions or other threats on the ground.

The vehicle is being designed to take off and land from the vertical position, and will be able to fly up to 250 nautical miles on a single tank of fuel. Eventually, these flying tanks may be used for strikes, raids, counterinsurgency operations, reconnaissance, medical evacuation and supply missions.

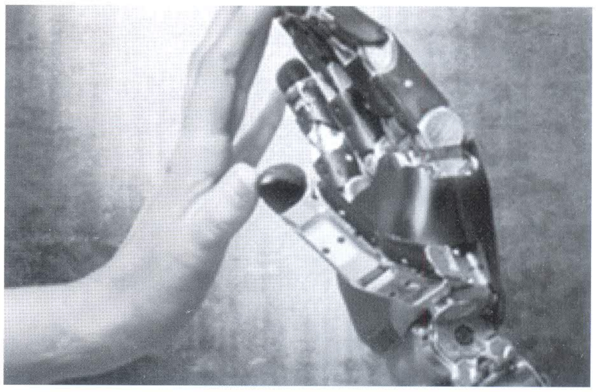
Mechanical kitties

Speaking of pets, cat lovers needn't feel neglected by the apparent lack of feline-inspired robots; there are several catlike robots out there, and they all have special skills.

Boston Dynamics' Cheetah is the fasted legged robot in the world, it can run on a treadmill at speeds reaching 29 mph (47 km/h). This remotely powered bot has never proven itself outdoors. However, its slower cousin, WildCat, is capable of navigating outdoor terrain. Created for DARPA's Maximum Mobility Manipulation (M3) program, WildCat is designed to be agile and flexible, to help soldiers with a wide range of missions.

Brain-Machine interfaces

Imagine if your brain could communicate with an external device, such as a thought-controlled mechanical arm or a device to restore sight. DARPA researchers are investigating potential communication pathways between the human brain and machines to build, assist, augment or repair human cognitive or sensory-motor functions.



Research on these so-called brain-machine interfaces began in the 1970s, and work by DARPA researchers is focused on neuroprosthetics that aim to restore damaged sight, hearing and movement. One of DARPA's brain-machine interface projects is Proto2, a thought-controlled prosthetic arm. Proto2 consists of a dexterous hand and fingers that can perform 25 joint motions.

AN INTERVIEW WITH A PIONEER

Mr. Madhusudan Bagepalli
Flight Simulation Specialist, Aviation & Aerospace

Madhusudan Bagepalli is currently working as a flight simulation specialist in Aeronautical development agency. He obtained his Bachelor of engineering (Mech) from National Institute of Technology, Mysore and Master of Engineering (Aerospace) from Indian Institute of Science, Bangalore.

What is the exact role of an Aeronautical engineer?

Aeronautical Engineering is an amalgamation of many technologies. It can be Mechanical, Electrical, Electronics, Propulsion, Avionics, Structural, Aerodynamics, Control & a wide domain of multi-disciplinary pillars of technology. Aeronautics is one such platform where the students are taught how these engineering disciplines are related to each other.

Are the concepts learnt during academics really useful?

What I would like to say is, that many of these topics you study is very essential in aeronautics. Consider the subject vibrations, most of the parts in an airplane are subjected to dynamic environments and hence it is inevitable. So one has to understand vibrations and be able to analyze & judge whether the design is a pass or a fail. The academic syllabi tells us about the theory and the principles and its applications; however instrumentation i.e. measurement of a quantity & understanding its characteristics, is missing. But all the concepts learnt in the academics are very important and essential.

Apart from academics, what must one do to reach higher potentials in these domains?

If you talk about Aeronautical industries as such, it is a pity that a lot of people will not get experience prior to joining the company. There is a huge gap between what one wants to do & what a company has to offer. CAD/CAM, PLM, Simulations etc. have become essential to begin working in the industry. That is the starting point of one's career and being informed of the latest technologies is of importance.

What is the present scenario of Aeronautical Industry in India?

A lot of industry in this field is Capital Intensive. Most of the projects are government funded since the capital investment is huge and the gestation period is large & takes a long time, up to ten years to complete and hence requires a lot of manpower. With respect to the manufacturing sector, the aircraft components require high precision manufacturing and huge investments which is not very common in our country. Recently private companies are coming in larger participation in producing aircrafts, satellites, space exploration and dependence on these industries in increasing. So the share of private industries is gaining momentum, most of which is driven by computer technology.

Sir, what are your comments on the startup revolution in our country and its effects on the Aeronautical Industries?

Yes, certainly. Now a days you can see many of these companies signing the tenders between countries or many of the contractual conditions which need to have an asset. Asset in terms of the agreements of sharing the economic backgrounds where they have to manufacture many components; startups play a major role in taking the responsibilities irrespective of the domains and also a lot of opportunities arise in the sequential developments. In the software side we have achieved an IT hub from the nation. There is a huge scope for upcoming entrepreneurs in this field.

How does one pursue a career in Aeronautical Engineering?

Pursuing masters in AE is open to all the students irrespective of their engineering background. Most of the institutes like IITs, NITs and other private institutes offer post graduate courses in the same field. A degree in mechanical engineering followed by masters in aeronautics will give a better perspective in the field.

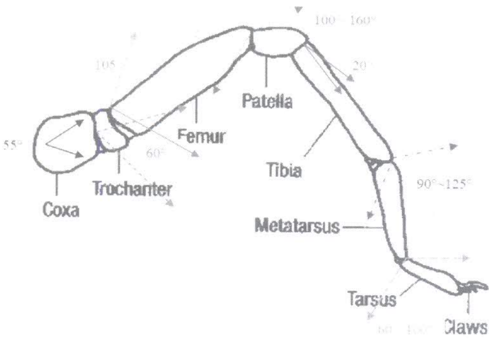
What is your message to the Budding Engineers?

Engineering is a degree which has a lot of respect. First thing is, one must be a professional; meaning one must respect other professions. Keep an open mind, observe and then react. All of us make mistakes, but when professionals sit together they sort out the problems. The essence of the meetings is to find solutions and not find faults. We have to be honest to say that we don't know. Most of us are average, so we should excel ourselves through efforts. I would like to quote what my professor said, "All of us have to dream big, but at the same time we must know what our capabilities are". The dream is big, but can I have it?! Keep the dream big, don't wear it down. Many of us don't get opportunities to do what we want to, hence be open to opportunities.

SPIDER ROBOT

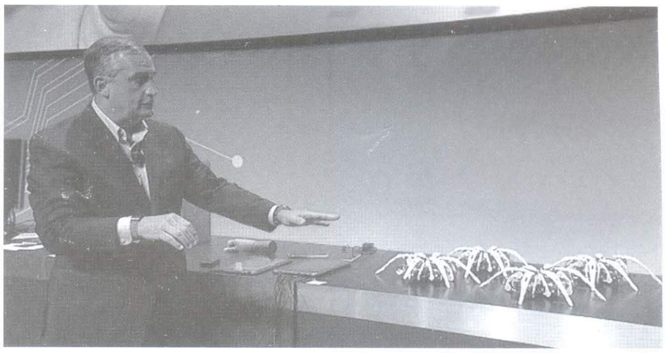
In conventional motion planning a wheeled mobile robot navigates toward a goal con- figuration while avoiding collision with obstacles. However, many motion-planning problems are more suited for legged robots that interact with the environment in order to achieve stable locomotion. For example, surveillance of collapsed structures for survivors, inspection and testing of complex pipe systems, and maintenance of hazardous structures such as nuclear reactors, all require motion in congested, unstructured, and complex environments. In this work a second generation of planar spider-like robot for quasi-static motion in tunnel environments has been developed. A control method for this class of robots is introduced. The control method is based on new results in the fields of grasp theory, and control of asymmetric 2nd-order linear systems. The control method ensures that when a spider-like mechanism bracing against the environment at equilibrium posture the naturally occurring compliance at the contacts stabilizes the mechanism as a single rigid body. Next an algorithm, named PCG, for selecting sequence of foothold positions along the tunnel has been developed. Finally, experimental results of the spider robot motion in tunnel environment verify the theories developed in this work.

Kinematic analysis of the robot motion shows that three links and three joints for each limb are required. However, when operating in a congested environment, additional degree of freedom is required in order to increase maneuverability while retaining a manageable mechanism complexity. The spider robot therefore consists of four links and four joints for each limb.



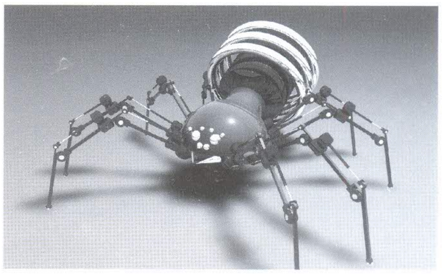
The spider's leg has seven limbs: coxa, trochanter, femur, patella, tibia, metatarsus and tarsus. Coxa is the first limb between the body and other limbs. As there are seven limbs in the leg of a spider, there are seven joints to be examined. The overall motion of the joints and limbs could be explained with the comprehensive study of muscular and hydraulic systems. Hydraulic systems are responsible for the movement of some of the limbs rather than muscular systems. Muscular systems of limbs have been studied by various researchers. Those who studied more than one family, found significant differences among the species.

As mentioned, spider legs differ a lot depending on the spider species or their ecology and so on. Therefore it is not plausible to state a longest or shortest limb for all species. Observation of twenty different spider species from Taiwan, North America and Africa made it possible to have a general idea about the rations of limb lengths. Limb lengths and their rations to each other or to other legs are stated in appendix. Although almost all of the ratios vary greatly for the set of reasons stated, two close ratios are found after studying of given number of spiders.



The ability of the spiders to walk and climb most of the natural and artificial surfaces, to overcome obstacles and change direction in a fast and suitable manner is surely related to their particular structure and shape. As a consequence, in order to better understand how the spider behaves in different environments and external conditions, the kinematics structure must to be evaluated.

Spiders can walk and climb on different terrain types and uneven grounds with their eight legs. In order to understand the spider locomotion efficiently, is necessary to study how each leg is moved, in which direction and which is the stepping pattern. Initially, the movement of each leg and their end point positions with respect to the surface are studied and then the stepping patterns and locomotion are investigated. Legs of different spider species demonstrate similar movements and each pair of legs.



This work studied the spider system in a bio-mimetic perspective. In particular the mechanisms that allow the spider to climb and overcome most of the existing surfaces and obstacles are evaluated. The attention focused on the spiders' legs in order to search and define both how the spider can climb and walk on different surfaces and how a spider-inspired robotic system can be built in order to assure such abilities.

KIROBO

A robot that acts as a friend for lonely astronauts in space has today been honored with two Guinness World Records titles.

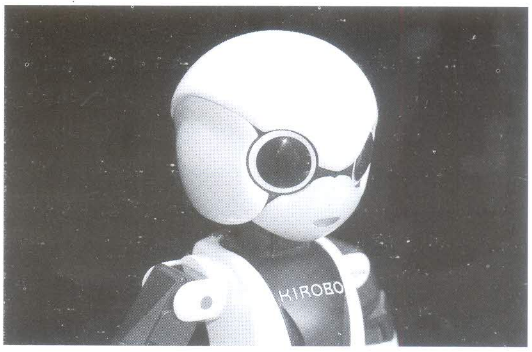
Kirobo, a small android able to have conversations in Japanese, has set records for first companion robot in space and highest altitude for a robot to have a conversation following an 18-month stay onboard the International Space Station.

Measuring 34 cm tall and weighing 1 kg, Kirobo can recognize faces, and has a sophisticated voice recognition system.

Able to stabilize itself in zero-gravity conditions, its onboard voice synthesis coupled with a library of pre-set gestures and an advanced language processing system allows it to speak in an uncannily natural manner.

The robot astronaut was developed as part of a five-year, joint research project carried out in collaboration between advertising agency Dentsu, the University of Tokyo's Research Center for Advanced Science and Technology, Robo-Garage, Toyota Motor Corporation, and JAXA the Japan Aerospace Exploration Agency.

One of the project's main aims was to test if a robot could provide psychological support to a human subject experiencing severe loneliness - such as an astronaut during an extended stay in space - by acting as their conversational partner.



Kirobo left earth via a HIIB rocket on 4 August 2013, with the mission to serve as a companion robot to the astronaut, Koichi Wakata.

After arriving at the ISS on the 10th, Kirobo gave its first speech eleven days later, declaring: "On August 21, 2013, a robot took one small step toward a brighter future for all."

On February 10, Kirobo came safely back to Earth aboard Space-X's CRS-5 Dragon cargo supply spacecraft which splashed down in the Pacific Ocean off California, arriving back in Japan on March 12.

The humanoid went on to achieve the highest altitude for a robot to have a conversation record on 7 December 2013 at an altitude of 414.2 kilometers above sea level after succeeding in having multiple meaningful conversations with Wakata.

PROCESS AUTOMATION

Robotic Process Automation (RPA) is a catalyst for business process transformation and innovation. It allows your best people to concentrate on the work that is strategically aligned to your business goals – the work that matters.

With Robotic Process Automation, you can easily automate business processes quickly and cost effectively without the need to create, replace or further develop expensive platforms. Finance & Accounting is a back-office function that is a perfect fit for RPA, as many of the processes are rules-based and can be easily performed by a robotic workforce.

Through our development of RPA, Sutherland has found that a 50-70 percent of work generally carried out by shared service, captive or outsourced operations can be automated leaving business exceptions, personal interactions, reviews or other judgment based work to be performed manually – moving these operations up the value chain.

Robotic Process Automation benefits often include 40% to 70% labor cost-reductions and near-zero error rates. It's no surprise, therefore, that so many organizations are looking to RPA to automate, digitize and standardize the bulk of their repetitive back-office work.

RPA is a non-intrusive technology, which limits INFOSEC concerns, and provides for the fastest way to increase the performance, quality and insight to any repeatable process.

DID YOU KNOW ?

"The first recorded mention of a robot comes from Leonardo DaVinci, all the way back in 1495. He wrote down his thoughts about 'mechanical knights' who would help in battle."

"Success is how high you bounce when you hit bottom"

HUMANOID ROBOTS

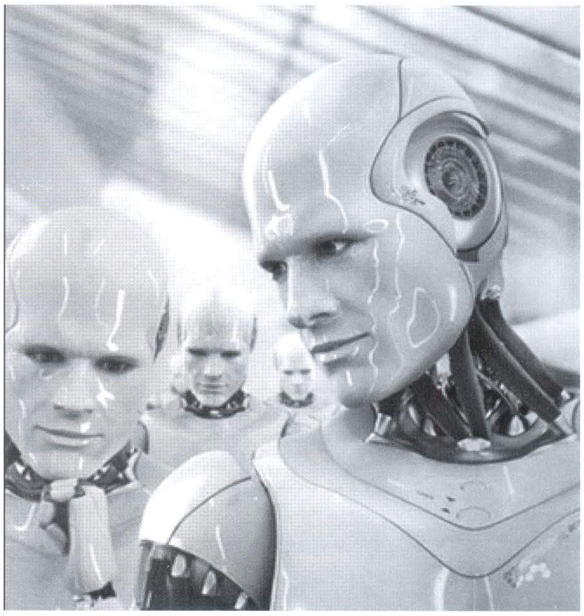
Human cognition is a field of study which is focused on how humans learn from sensory information in order to acquire perceptual and motor skills. This knowledge is used to develop computational models of human behavior and it has been improving over time.

Researchers need to understand the human body structure and behavior (biomechanics) to build and study humanoid robots. On the other side, the attempt to the simulation of the human body leads to a better understanding of it. It has been suggested that very advanced robotics will facilitate the enhancement of ordinary humans.

Although the initial aim of humanoid research was to build better orthotics and prosthesis for human beings. A few examples are: powered leg prosthesis for neuromuscular impaired, ankle-foot orthotics, biological realistic leg prosthesis and forearm prosthesis.

Besides the research, humanoid robots are being developed to perform human tasks like personal assistance, where they should be able to assist the sick and elderly, and dirty or dangerous jobs. In essence, since they can use tools and operate equipment and vehicles designed for the human form, humanoids could theoretically perform any task a human being can, so long as they have the proper software. However, the complexity of doing so is deceptively great. Humanoid robots, especially with artificial intelligence algorithms, could be useful for future dangerous and/or distant space exploration missions, without having the need to turn back around again and return to Earth once the mission is completed.

Proprioceptive sensors sense the position, the orientation and the speed of the humanoid's body and joints. Humanoid robots use accelerometers to measure the acceleration, from which velocity can be calculated by integration; tilt sensors to measure inclination; force sensors placed in robot's hands and feet to measure contact force with environment; position sensors, that indicate the actual position of the robot or even speed sensors.



Vision refers to processing data from any modality which uses the electromagnetic spectrum to produce an image. In humanoid robots it is used to recognize objects and determine their properties. Vision sensors work most similarly to the eyes of human beings. Most humanoid robots use CCD cameras as vision sensors.

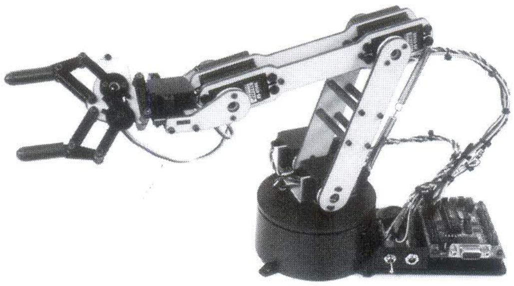
Sound sensors allow humanoid robots to hear speech and environmental sounds, and perform as the ears of the human being. Microphones are usually used for this task.

The question of walking biped robots stabilization on the surface is of great importance. Maintenance of the robot's gravity center over the center of bearing area for providing a stable position can be chosen as a goal of control. To maintain dynamic balance during the walk, a robot needs information about contact force and its current and desired motion. The solution to this problem relies on a major concept, the Zero Moment Point (ZMP).

Humanoids don't yet have some features of the human body. They include structures with variable flexibility, which provide and redundancy of movements, Although these characteristics are desirable to humanoid robots, they will bring more complexity and new problems to planning and control.

ROBOTIC MANIPULATORS

Robotics manipulator is a device used to manipulate materials without direct contact. The applications were originally for dealing with radioactive or biohazardous materials, using robotic arms, or they were used in inaccessible places. In more recent developments they have been used in applications such as robotically-assisted surgery and in space. It is an arm-like mechanism that consists of a series of segments, usually sliding or jointed, which grasp and move objects with a number of degrees of freedom.



In industrial ergonomics a manipulator is a lift assist device used to help workers lift, maneuver and place articles in process that are too heavy, too hot, too large or otherwise too difficult for a single worker to manually handle. As opposed to simply vertical lift assists (cranes, hoists, etc.) manipulators have the ability to reach in to tight spaces and remove workpieces. A good example would be removing large stamped parts from a press and placing them in a rack or similar dunnage.

Additionally, manipulator tooling gives the lift assist the ability to pitch, roll, or spin the part for appropriate placement. An example would be removing a part from a press in the horizontal and then pitching it up for vertical placement in a rack or rolling a part over for exposing the back of the part.

DID YOU KNOW ?

"The first humanoid robot was debuted in 1939. Elektro, built by Westinghouse, was seven feet tall and could speak 700 words."

CAREER IN ROBOTICS

Work in robotics more closely resembles invention rather than pure science or pure engineering. Science refers to a system of acquiring knowledge. Engineering is the design, analysis, and/or construction of works for practical purposes. Invention is about creating something new, often at the boundaries of scientific and technological knowledge.

A **Roboticist** is a person who designs, builds, programs, and experiments with robots. Since robotics is a highly interdisciplinary field, roboticists often have backgrounds in a number of disciplines including computer science, mechanical engineering, engineering, physics, humancomputer interaction and interaction design. Roboticists often work for university, industry, and government research labs, but may also work for startup companies and other entrepreneurial firms. Amateur Robotics is also a growing hobby all over the world.

Robots recently became a popular tool in raising interests in computing for middle and high school students. First year computer science courses at several universities were developed which involves the programming of a robot instead of the traditional software engineering based coursework. Universities offer Bachelors and Masters Degrees in the field of robotics. Select Private Career Colleges and vocational schools offer robotics training to train individuals towards being job ready and employable in the emerging robotics industry.

You generally need at least a bachelor's degree in engineering to enter this field. Because robotics technology draws on the expertise of many different engineering disciplines, engineers who specialize in robotics often have degrees in mechanical, manufacturing, electrical, electronic, or industrial engineering.

Some colleges and universities now offer robotics engineering degrees. Robotics courses typically include training in hydraulics and pneumatics, CADD/CAM systems, numerically controlled systems, microprocessors, integrated systems, and logic. It usually takes four to five years to earn a bachelor's degree in engineering. Some colleges offer work-study programs in which students receive on-the-job training while still in school. Most universities that offer robotics courses have well-equipped labs with lasers and CADD/CAM equipment. For most positions and to advance in the field you need a master's or doctoral degree. Robotics engineers must continually upgrade their technical knowledge to keep abreast of new developments in this rapidly changing field.

Proficiency in mathematics and physics will be helpful for the job, so does a Good knowledge of the principles involved in the field. Many in the industry also utilize vivid imagination and get solutions and also those who have tactile abilities to help with their work. So this means that there are career opportunities in robotics as well

Robotics engineers design robots, maintain them, develop new applications for them, and conduct research to expand the potential of robotics. This is a rapidly developing field, with advances in computing constantly opening up new possibilities for robotics applications.

DID YOU KNOW ?

"Cybernetics professor Kevin Warwick calls himself the world's first cyborg, with computer chips implanted in his left arm. He can remotely operate doors, an artificial hand, and an electronic wheelchair."

"You must do the things you think you cannot do"

NEXT EDITION: AUTOPILOT

An auto pilot is a system used to control the trajectory of a vehicle without constant 'hand-on' control by a human operator being required. Auto pilot do not replace a human operator, but assist them in controlling the vehicle, allowing them to fovous on boarder aspects of operation, such as monitoring the trajectory, weather and system. Autopilot have evolved significantly over time, from early autopilots that merely held an attitude to modern autopilot capable of performing automated landing under the supervision of a pilot.

The autopilot system on airplanes is sometimes colloquially referred as "GEORGE". Inn the early days of aviation, aircraft requires the continuous attention of a pilot in order to fly safe. As aircraft range increased allowing flights of many hours, the constant led to serious fatigue. An autopilot is designed to perform some of the tasks of the pilot. The first aircraft autopilot was developed by Sperry Corporation in 1912. The autopilot connected a gyroscope heading indicator to hydraulically operated elevators and rudder.

It permits the aircraft to fly straight and level on the compass course without a pilot's attention, greatly reducing the pilot workload. In1930, the royal aircraft establishment in England developed an autopilot called a pilot's assister that used a pneumatically spun gyroscope to move the flight controls. Further development of the autopilot was performed, such as improved control algorithms and hydraulic servo mechanisms. Also, inclusion of additional instrumentation such as the radio-navigation aids made it possible to fly during night and in bad weather. In 1920 the standard oil tanker J.A. Moffet became the first ship to use an autopilot.

TEST YOUR BRAIN

- **The term Robot comes from the Czech word "Robota" meaning........................**
- **What is one of the most difficult tasks for a Robot to perform...................**
- **Robots cannot be like humans because they lack......................................**
- **The development of Robotics would NOT be possible without....................**
- **The most common Robot in our society today is the Robotic.......................**

ANSWERS

Forced Labour	Walk	Creativity	Computer	Arm	Micro-Robots

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