REVIEW PAPER ON AUTOMATION OF ROBOTICS IN SPATIAL WITH LIFE FORMS

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Abstract- **The manuscript contains simulation of robotics with natural life forms. As the concept of being drawn into field of robotics can be found as long as the 4th century BC, when the greek mathematician Archytas of Tarentum postulated of mechanical bird he called "The Pigeon", was propel by stream. Taking up the earlier reference in Homer's Lliad, Aristotle speculated in the Politics that automata (formally automation) could someday bring about human equality by making possible the abolition of slavery of humans. So, according to that particular sequence human race started the production of automated devices due to some main reasons: mass production and self replication, advanced and artificial intelligence, up gradation of knowledge and to build dynamic morphologies to enable technology potential and to evolve physiological predispositions.**

I. INTRODUCTION

A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of variety of task. The study of robotics concerned with the main for a relatively high level of combination of 4 basic tech: Automated control and handling of mechanical parts, Propulsion mobility, system vision and artificial intelligence (A.I).

There are many robots which are design for sensing, accumulating, computing and for other type of industrial purposes. Now a day many type of robots are design for space science, mining and building purposes. As an example humans and animals have arms and fingers to manipulate objects. Lags for locomotion muscles as actuators, eyes provide vision, nose for smelling, skin for feeling and nerves for communicating between the brain and actuators.

II. THE BASIC TECHNIQUES IN ROBOTICS

As we compare robots and humans manipulation is equal to arms and fingers driven by motors and other forms of actuation. Vision is equal to camera, hearing is equal to microphone, feeling is equal to tactile sensors, and communication is equal to wires, fibers, optics and radio. Brain is equal to computers and microprocessors.

As the techniques are often developing advance but the need of resolving the conditions of the robotics system is increase day to day. Many types of sensors and components have been still need to upgrade with different material and component as robots are being upgraded in spatial with life forms (homosapians), there is need to make their structure such active as the structure of human beings. Hence to improve and upgrade the system of machine we need to put down some efforts and experiments.

III. UPGRADATION IN PHYSICAL (EXTERNAL) MATERIAL

As there is plenty of choice when it comes to choosing the building material for robots. There are four groups of materials. Each of these groups have own characteristics, possibilities and difficulties.

There are 80 different pure metals each having different properties. But they all have some basic disadvantages that we cannot use them in pure form. Some commonly used alloys:

Duraluminium – It is the most strong as soft steel but very light to be used in machine because it does not give required body weight.

Steel-It is very good alloy of nickel and iron have good hardness, strength and rust resistance. But it causes welding problem and heats up gradually at the time of drilling and requires time for cooling down.

Copper – It is used in wires or axles. But it is heavy and increases unwinnable body mass of machine.

So, in order to solving the problems discussed above, many different supplements can be used for the betterment, advancement and up gradation in field of robotics such as use of Shape Memory Alloy (SMA).

Shape memory alloy- it is an alloy that ”remembers ” its original shape and then when deformed returns to its pre deformed shape when heated lightly. This material is a light weight, solid state alternative to application of robotics. This material is beneficial in providing extra strength and recovering tendency to robot body.

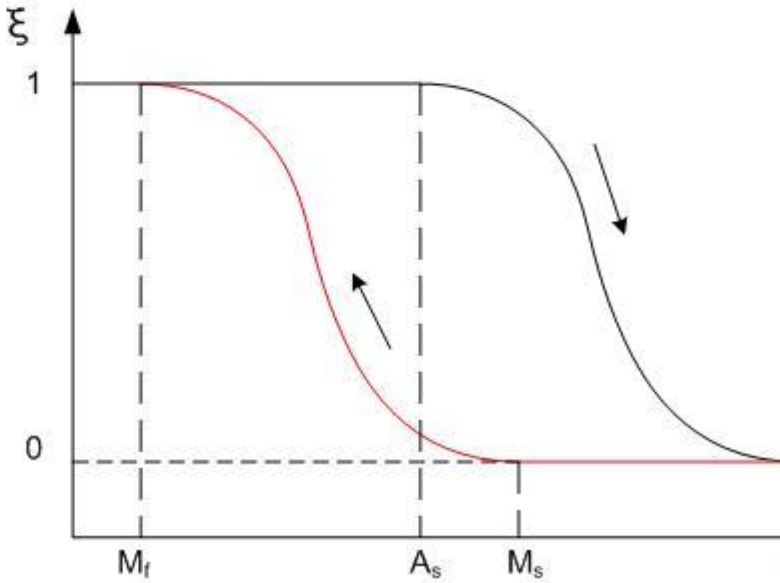
The two main types of SMA are:-

1. Copper –Aluminiun-Nickel
2. Nickel-titanium (NiTi)

Although SMA's can also be made by using Copper, Zinc, Gold and Iron which are commercially available due to cheaper cost and their high stability. SMA's can exist in two different phases, with three different crystal structure(i.e. twinned marten site, detained marten site and austenite) and six possible transformation.

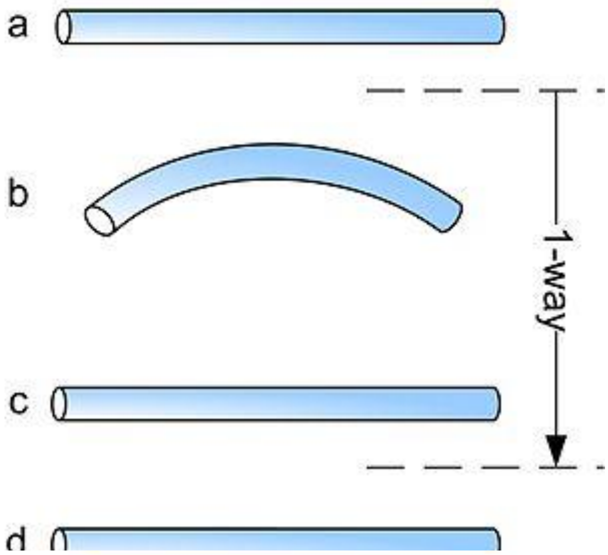
NiTi alloys change from austenite to marten site upon cooling: M_f is the temperature at which the transition to marten site completes upon cooling. Accordingly, during heating As and A_f are the temperatures at which the transformation from marten site to austenite starts and finishes. Repeated use of the shape-memory effect may lead to a shift of the characteristic transformation temperatures (this effect is known as functional fatigue, as it is closely related with a change of micro structural and functional properties of the material). The maximum temperature at which SMAs can no longer be stress induced is called M_d, where the SMAs are permanently deformed.

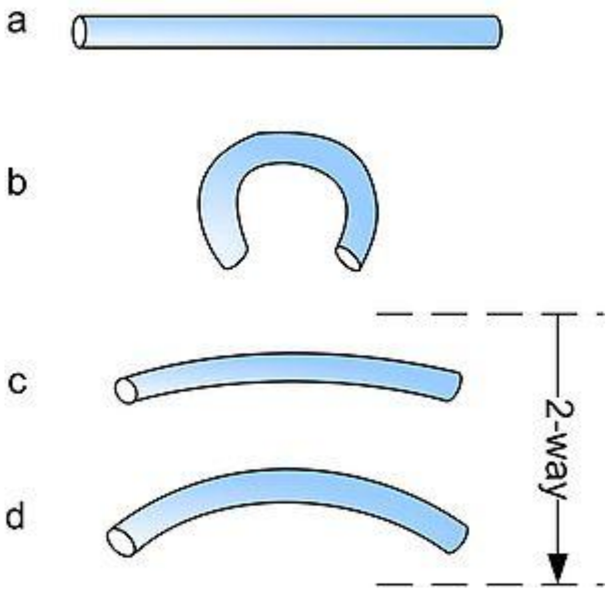
The transition from the marten site phase to the austenite phase is only dependent on temperature and stress, not time, as most phase changes are, as there is no diffusion involved. Similarly, the austenite structure receives its name from steel alloys of a similar structure. It is the reversible diffusion less transition between these two phases that results in special properties. While marten site can be formed from austenite by rapidly cooling carbon-steel, this process is not reversible, so steel does not have shape-memory properties.



In this figure, ξ (T) represents the marten site fraction. The difference between the heating transition and the cooling transition gives rise to hysteresis where some of the mechanical energy is lost in the process. The shape of the curve depends on the material properties of the shape-memory alloy, such as the allowing and work hardening.

Shape-memory alloys have different shape-memory effects. Two common effects are one-way and two-way shape memory. A schematic of the effects is shown below.





The procedures are very similar: starting from marten site (a), adding a reversible deformation for the one-way effect or severe deformation with an irreversible amount for the two-way (b), heating the sample (c) and cooling it again (d).

A. ONE-WAY MEMORY EFFECT

When a shape-memory alloy is in its cold state (below A_s), the metal can be bent or stretched and will hold those shapes until heated above the transition temperature. Upon heating, the shape changes to its original. When the metal cools again it will remain in the hot shape, until deformed again.

With the one-way effect, cooling from high temperatures does not cause a macroscopic shape change. A deformation is necessary to create the low-temperature shape. On heating, transformation starts at A_s and is completed at A_f (typically 2 to 20 °C or hotter, depending on the alloy or the loading conditions). A_s is determined by the alloy type and composition and can vary between −150 °C and 200 °C.

B. TWO-WAY MEMORY EFFECT

The two-way shape-memory effect is the effect that the material remembers two different shapes: one at low temperatures, and one at the high-temperature shape. A material that shows a shape-memory effect during both heating and cooling is said to have two-way shape memory. This can also be obtained without the application of an external force (intrinsic two-way effect). The reason the material behaves so differently in these situations lies in training. Training implies that a shape memory can "learn" to behave in a certain way. Under normal circumstances, a shape-memory alloy "remembers" its low-temperature shape, but upon heating to recover the high-temperature shape, immediately "forgets" the low-temperature shape. However, it can be "trained" to "remember" to leave some reminders of the deformed low-temperature condition in the high-temperature phases. There are several ways of doing this. A shaped, trained object heated beyond a certain point will lose the two-way memory effect.

IV. UPGRADATION IN CONNECTING TECHNIQUES

For most metals, the relationship between electrical and thermal conductivity is governed by the Weidman-Franz Law. Simply put, the law states that good conductors of electricity are also good conductors of heat. That is not the case for metallic vanadium dioxide, a material already noted for its unusual ability to switch from an insulator to a metal when it reaches a balmy 67 degrees Celsius, or 152 degrees Fahrenheit.

"This was a totally unexpected finding," said study principal investigator Junqiao Wu, a physicist at Berkeley Lab's Materials Sciences

Division and a UC Berkeley professor of materials science and engineering. "It shows a drastic breakdown of a textbook law that has been known to be robust for conventional conductors. This discovery is of fundamental importance for understanding the basic electronic behavior of novel conductors." "The electrons were moving in unison with each other, much like a fluid, instead of as individual particles like in normal metals," said Wu. "For electrons, heat is a random motion. Normal metals transport heat efficiently because there are so many different possible microscopic configurations that the individual electrons can jump between. In contrast, the coordinated, marching-band-like motion of electrons in vanadium dioxide is detrimental to heat transfer as there are fewer configurations available for the electrons to hop randomly between."

Notably, the amount of electricity and heat that vanadium dioxide can conduct is tunable by mixing it with other materials. When the researchers doped single crystal vanadium dioxide samples with the metal tungsten, they lowered the phase transition temperature at which vanadium dioxide becomes metallic. At the same time, the electrons in the metallic phase became better heat conductors. This enabled the researchers to control the amount of heat that vanadium dioxide can dissipate by switching its phase from insulator to metal and vice versa, at tunable temperatures.

Such materials can be used to help scavenge or dissipate the heat in engines, or be developed into a window coating that improves the efficient use of energy in buildings, the researchers said.

"This material could be used to help stabilize temperature," said study co-lead author Fan Yang, a postdoctoral researcher at Berkeley Lab's Molecular Foundry, a DOE Office of Science User Facility where some of the research was done. "By tuning its thermal conductivity, the material can efficiently and automatically dissipate heat in the hot summer because it will have high thermal conductivity, but prevent heat loss in the cold winter because of its low thermal conductivity at lower temperatures."

Vanadium dioxide has the added benefit of being transparent below about 30 degrees Celsius (86 degrees Fahrenheit), and absorptive of infrared light above 60 degrees Celsius (140 degrees Fahrenheit).

V. UPGRADATION IN STORAGE TECHNIQUES

From the past few years much advancement are being occurred in the field of storage in handling techniques from the earlier times as lead-acid batteries are used in power supply for automotive machines. As a result they conquer too much of space and costs high and have low reliability.

Vanadium Redox Flow Batteries:-

The vanadium radox battery energy storage system (VRB) is a flow battery that is capable of storing energy in multi megawatt ranges and for durations of hours or days - from any available input source such as the grid, renewable resources or a diesel generator. The stored energy can be returned to the grid or supplied to a load as required and directed. The VRB is capable of being charged as quickly as it was discharged and is able to respond to all forms of power quality variations and can be operated in a UPS mode as well. For loads which require reactive energy, the VRB can provide VARS on a continuous basis either when charging or discharging. Flow batteries are further described in this previous post. The durability and wide design options of vanadium batteries promise large markets for many applications, such as load leveling, storage in renewable energy systems (e.g. wind and solar) and un interpretable power supplies. VRB's are based on the patented vanadium-based red ox regenerative fuel cell that converts chemical energy into electrical energy. Red ox is the term used to describe electrochemical reactions in which energy is stored in two solutions with electrochemical potentials sufficiently separated from each other to provide an electromotive force to drive the oxidation-reduction reactions. In the VRB energy is stored chemically in different ionic forms of vanadium in a dilute sulfuric acid electrolyte. This creates a current that is collated by electrodes and made available to an external circuit. The reaction is reversible allowing the battery to be charged, discharged and recharged.

The cost is quoted in $/kWh or $/MWh since the VRB is an "Energy Storage System" and should not be considered a UPS or even a generator. Although the VRB provides the full UPS capability, its primary use is for energy storage for long periods, which UPS and conventional technologies cannot provide. As an approximate cost, systems are priced between $350-$600 per kWh, sizes ranging from a few hundred kW's to MW size systems. As the size of the system in kWh increases, the cost per unit decreases significantly. For example, a system rated at 100MWh would have an installed cost of about $325 per kWh. The incremental cost of storage for large systems is approximately $150 per kWh.

In order to performance the VRB has an availability of greater than 98%. It is designed for unattended operation with very low maintenance costs.

No degradation from repeated deep charges and discharges. The system can be discharged and charged greater than 13,000 times (20% to 80% SOC) without deterioration in system efficiencies.

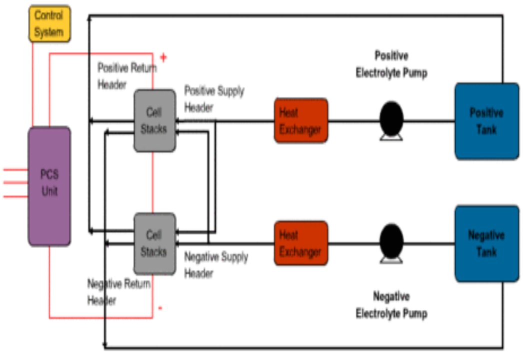
System round-trip efficiencies between 70% - 78%.

The VRB-ESS has a charge/discharge window of 1:1 - allowing off-peak charging for on-peak dispatch - a fraction of the time required by other battery systems and ideal for wind generation applications.

Cross mixing of electrolytes does not lead to contamination of electrolytes

Once charged, the electrolyte remains fully charged with low self-discharge.

Graphite is built on fixed-size databases (see whisper) so we have to configure in advance how much data we intend to store and at what level of precision. For instance you could store your data with 1-minute precision (meaning you will have one data point for each minute) for say 2 hours. Additionally you could store your data with 10-minute precision for 2 weeks, etc. The idea is that the storage cost is determined by the number of data points you want to store, the less fine your precision, the more time you can cover with fewer points.



VI. CONCLUSION

In the starting we discuss about the physical strength, energy connection/convention and storage management in the field of automation and robotics. The advancement in the alloys formation for physical structure. So as a result we can conclude that above techniques can be used for making the field of robotics better to serve for future generations in spatial to life forms.

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