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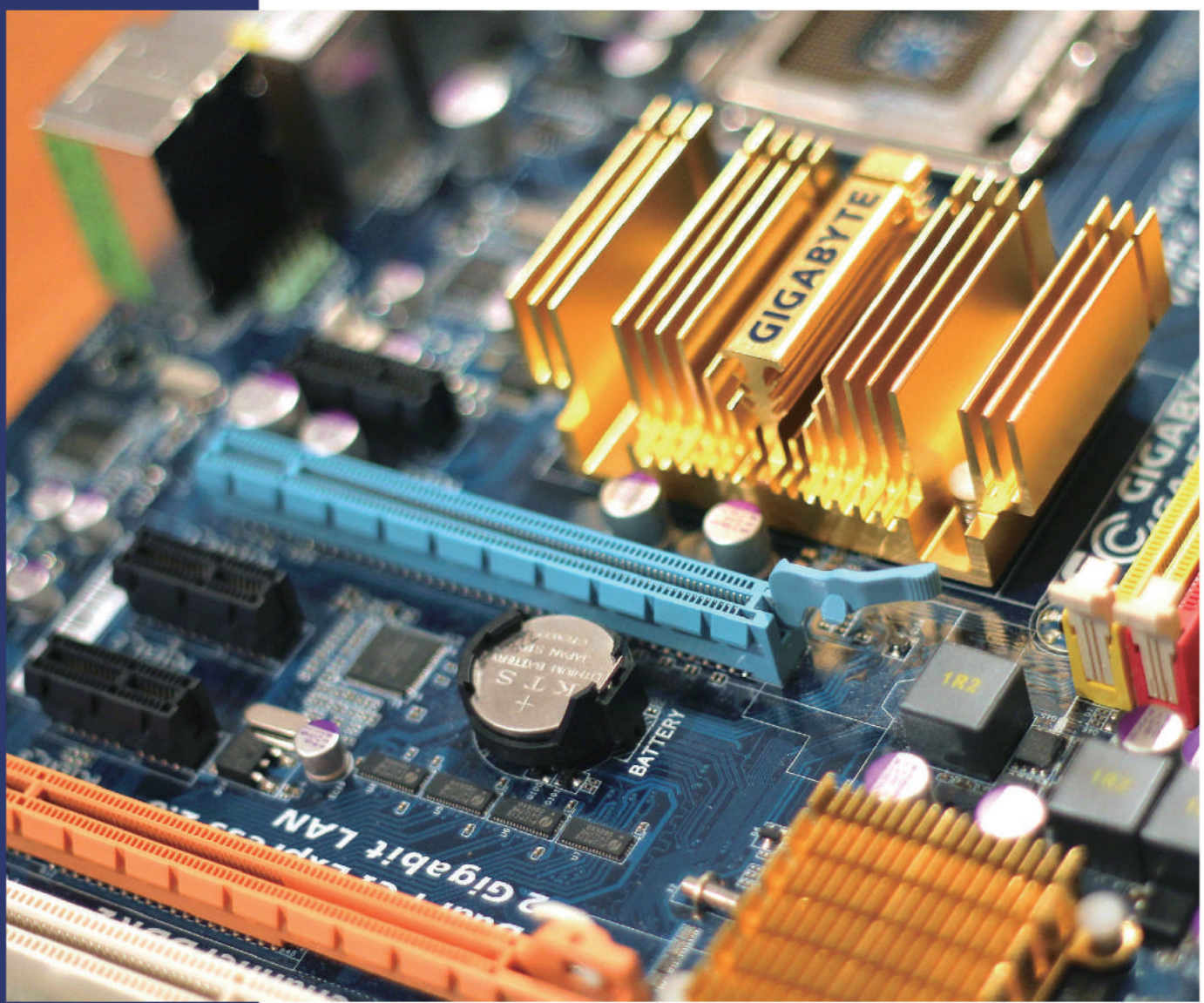

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ARTICLE

Dynamics Models of Crank in Motor Housing Process

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ABSTRACT

With regards to the assembly line of cost control of Dechang(HK) company, the motor housing's cost control of process will be necessarily respected. Because the supply quantity is big in a machine the price of motor housing is small, so that the cost control of automatic production line is significant with modeling. It is found that the control of equipment includes in shaft and crank linkage for benefit which also needs to be controlled in detail. For the sake of benefits can we fundamentally resolve the main problem of high cost process.

1. Introduction

Motor housing can be used in assembly line production, because of its thin thickness, can work in the machine line.In the process of stamping, the coil steel plate and the punch press are connected into four working procedures, and three deep drawing operations in a short time to complete the continuous processing of the motor shell.They produce a lot of products in a certain amount of time.Since the production line is an automatic feed punch, it is difficult to control the cost.So we should focus on this cost issue and work for scientific management, networking and digital AI management. Due to excessive machine fatigue, and the processing speed is also fast, we need to carry out timely routine inspection of the machinery and equipment and focus on the hidden faults.This saves the cost of the trip to the manufacturer's personnel for repair due to machine failure and the loss caused by the shutdown of the machine.Because the load and frequency of the machine do not keep up with the loss caused by the fatigue condition under the load of the raw material and the mold, the economic efficiency of the control structure of the crankshaft is an important factor in the automation industry.This paper discusses the crankshaft from the technical point of view of economic benefit. [1~4] the crank is the most critical power mechanism, which turns the rotating motion of the spindle into the linear motion of the ramming motor shell and pushes and presses the thin steel plate.Therefore, the kinematics and dynamics of the crank are studied in order to optimize the crank parameters and save energy and high efficiency.

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2. Model Derivation

2.1 Impact Mode Dynamics of Motor Housing

It is the process of three times of power in motor shell punching, as shown in figure 3.

According to the concept of mechanical power,

because $dP=F_1 d(1/t)$ (1)

Here $\sigma = F / A = \frac{4F}{\pi d_1^{\,2}}$ (2)

It has $F = \sigma_1 \pi d_1^{\,2} / 4$ (3)

According to the energy conservation law

$$F = \frac{mv^2}{2l_1} \tag{4}$$

Here $v = \frac{\pi d_0 n}{90}$ (5)

v is crank's doing circulation movement at the diameter of $\rho_z d_0$ [2].

$$\rho_z = \sqrt{\frac{J_z}{m}} \tag{6}$$

$$J_z = 1/2mR^2 \tag{7}$$

Substitute (6) into (7) it gains

$$\rho_z = \frac{R}{\sqrt{2}} \text{ ie } \rho_z = 0.707 \tag{8}$$

Substitute (4) into above equation (5) it has

$$dF = \frac{md(\pi d_0 n)^2}{16200 \times l_1} \tag{9}$$

According to the defining with torque

$$T = Fd_0 \tag{10}$$

$$\& \; T = 9.55 \times 10^5 P / n \tag{11}$$

replace (11) with equation (10) and gains

$$P = \frac{Fd_0 n}{9.55} \tag{12}$$

Replace (12) with (9) and gains

$$P = \frac{\pi n d_0 \sigma d_1^{\,2}}{10.74} \tag{13}$$

Here, v mm/s is the rotation speed of the driving wheel discussed above; N r/min is rotation; P Kw is the power; T is the torque NKm. F_1 is the force exerted by the punch at the first stroke; σ_1 is the impulse pressure. As shown in Table 1, ts is the time of the first punch, m; D_1 is the diameter of the punch hole, which is the same as the diameter of the first punch shell. L_1 is the punching length, which is the same as the first punching shell length mm; T is the thickness. D_0 is the final die diameter.

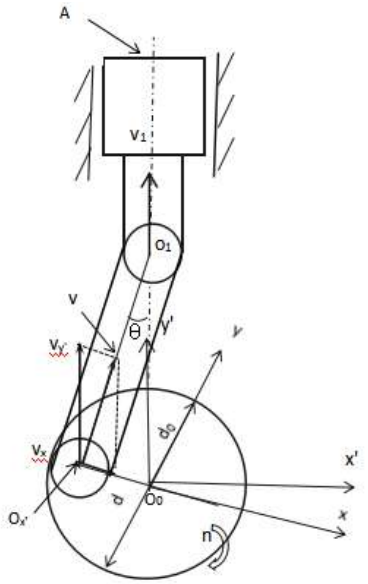

Figure 1. the kinematic of crankshaft linkage in the first motor housing process

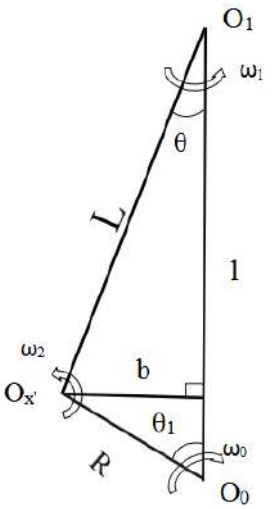

Figure 2. the kinematic of crankshaft linkage

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2.2 Movement Analysis of Crankshaft Connecting Rod Structure

2.2.1 Kinematic Equations

Figure 1 shows the kinematics diagram of crankshaft connecting rod device.The center of the coordinate system x-y is O_0, the crankshaft is the OxO_0 part, and the O_0 circular axis is the drive axis, which rotates n (RPM).Connect the die O_1A through $O_0O1.O_1A$ in the x'-y' coordinate system moves back and forth in a straight line in the y' direction of the orbit, moving at speed v_1.In frame x prime minus y prime, v_1 is equal to v sub y prime.Angle theta is the Angle between the die and the crank. A is the die acceleration; D is the length of the crank, that is, the diameter of the cyclotron; D_0 is the diameter of the drive shaft.As shown in Figure 3, the stamping steel plate mold is O_1A in figure 1.Where a is the first punch, d1 and l1 are the diameter and length of the first punch.B is the second punch, and c is the fourth punch of cutting die.The third and fifth steps are omitted here.The third process is the final product size, which is similar to the second process, so it is omitted in this paper.The fifth step is to remove the shell to the designated point, as shown in the basket below, to facilitate storage and transportation. Assuming that all the forces are the same as F, it is only necessary to analyze the force on the first impact mold. The force analysis process is as follows.

The final member of the connecting rod structure by the crankshaft, namely the section O_0Ox' in the figure, has

$$v_0 = \pi dn \tag{14}$$

According to lever structure principle in Figure 1

$$v_{y'} = \frac{v}{\cos\theta} \tag{15}$$

Due to Figure 2 $v_{y'} = v_1$ (16)

So that $v_1 = \frac{v}{\cos\theta}$ (17)

Here θ is included angle between mould and crank, so that

$$v_1 = \frac{v_0}{\cos\theta} \tag{18}$$

Due to the stamping parts with ultimate velocity is zero

$$v_1 + at = 0 \tag{19}$$

$$\& \ dv_1 / dt = -a \tag{20}$$

a is acceleration of stamping parts.

Supposed that stamping time is below

t=0.3s (21)

(9) take the place of (10) and gain

$$a = \frac{-\pi dn}{t\cos\theta} \tag{22}$$

2.2.2 Equation derivation of the included Angle between connecting rod and center line

Figure 2 is a schematic diagram of crank linkage mechanism, and the parameter can be derived from the following. Set $Ox'O_1 = L$, d = R, b is perpendicular to the L and $O_1O_0 = L$

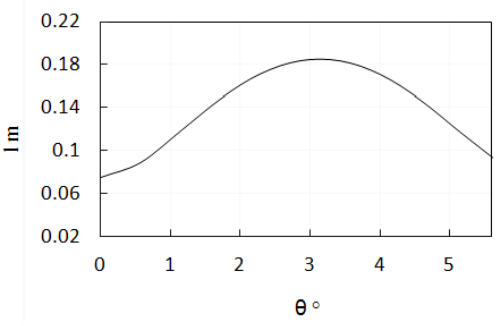
$$l = R\cos\theta_1 + L\cos\theta \tag{23}$$

$$\& \ b = L\sin\theta = R\sin\theta_1 \tag{24}$$

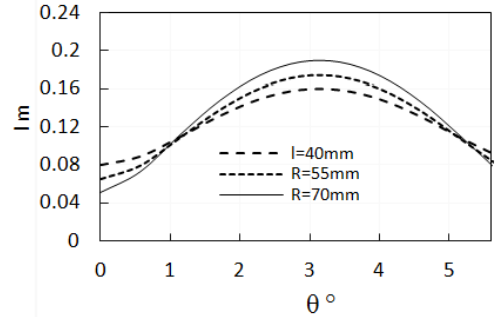
Since law of cosines

$$l^2 = R^2 + L^2 - 2R\cos\theta \tag{25}$$

According to above formula supposes that R=40mm, L=120mm and l=R+L-ΔS=160-30= 130 mm. This is the initial Angle of crank drive mould, Δ S for slider here is about equal to 30 mm mold slip effectively.



(a) R=55mm, L=130mm



(b) R=40mm,55mm,70mm & L=120mm

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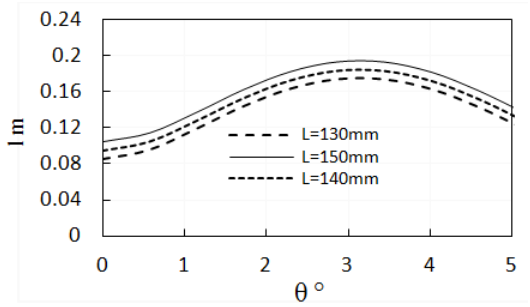
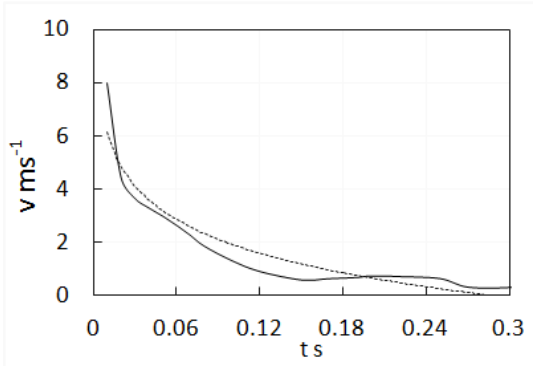
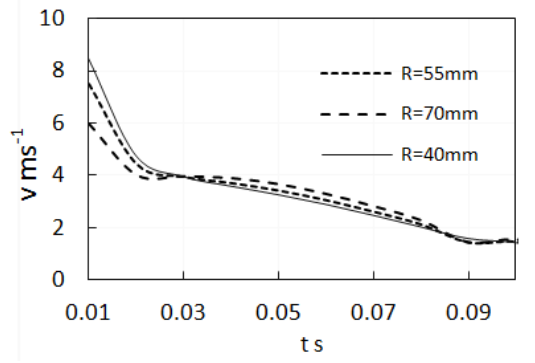


(c) L=130mm,140mm,150mm & R=45mm

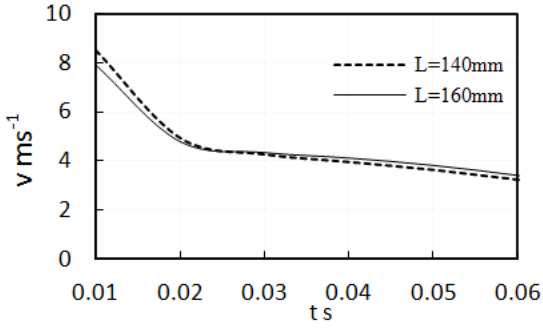
Figure 3. relations of crank length lc and angle in strokes under different R &L



(a) R=40mm, L=120mm

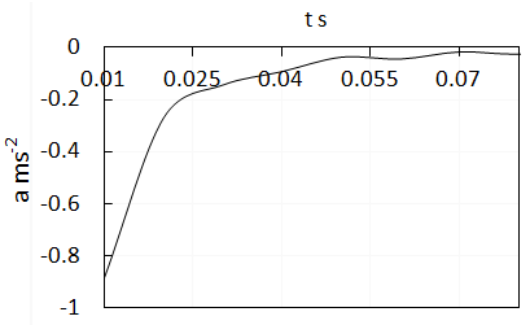


(b) R=40mm, R=55mm, R=70mm &L=130mm

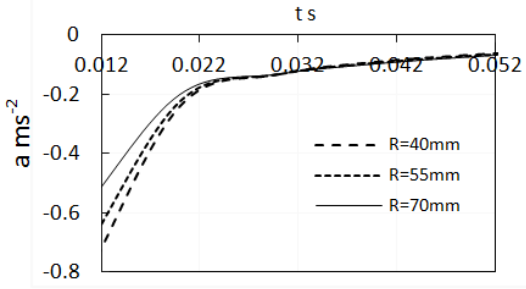


(c) L=140mm,160mm& R=55mm

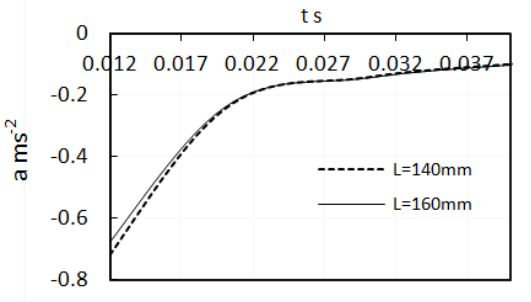
Figure 4. The relations of strokes velocity and time with the parameter R & L



(a) R=40mm, L=120mm



(b) R=40mm, R=55mm, R=70mm &L=130mm



(c) L=140mm,160mm &R=55mm

Figure 5. The relations of strokes acceleration and time with the parameter R & L

Figure 4(a) shows the data under R=45mm and L=130mm.This indicates that the initial speed in the die is up to 500mm/s and the die speed decreases with the increase of time, that is, with the increase of the stamping length.If the stamping time is less than 70m/s in 0.2 seconds, it means that the stamping time is better than 0.3 seconds.FIgure 5(a) shows that the velocity gradually decreases as time increases and finally approaches zero.The change was large before the time was 0.05 seconds, and then moderated. Figure 5(b) curves under R=45mm and L=130mm.It indicates that the distance l between the mold and the center of the drive axis gradually increases with the decrease of Angle from 5.4°, and gradually decreases after 3°.Figure 5 (c) is at L=140mm, and there is no big change in the acceleration of 160mm.At 0.01~0.02s, the curve of 140mm is larger than the absolute value of 160mm, and there is no difference after 0.02s.It indicates

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that the acceleration of the mold changes within the first 0.02s when L changes.

Figure 3(b) shows the L change when the crank radius R changes when L=120mm, which is similar to Figure. 5(a) in a sinusoidal curve.As R gets bigger and l gets bigger, the stroke gets bigger.When R=40mm, l is 0.07m, while when R=70mm, l becomes 0.12m. Figure 3 (c) shows their curves under L=130mm,140mm,150mm & R=45mm.

3. Conclusions

(1) With the increase of time, that is, with the increase of stamping length, the mold speed decreases gradually. Reach below 70m/s in 0.2 seconds.As time goes up, the velocity goes down and it goes to zero.

(2) At 5.4°, the distance l between the mold and the center of the drive axis gradually increases with the decrease of Angle, and after 3°, the l gradually decreases.

(3) When the crank radius R changes, l changes it shows a sinusoidal curve. As R gets bigger and l gets bigger, the stroke gets bigger.

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ARTICLE

Inverter System: A Solution to Improve the Efficiency of New Energy Generation in Factories

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ABSTRACT

The report mainly analyzes whether the inverter system could improve the efficiency of converting new energy into factory electricity based on McLuhan's laws of media theory. Firstly, the report asserts the significance of using new energy and the importance of utilizing the inverter system to improve the power conversion of new energy in factories. Secondly, it mainly describes McLuhan's theory from four different aspects. In addition, according to the four aspects of McLuhan's theory, the rationality and feasibility of the inverter system solution are analyzed. Then, it is concluded that the inverter system can well improve the conversion efficiency of new energy generation in factories. Finally, this paper claims suggestions from two different perspectives to promote the development of the inverter system. .

1. Introduction

1.1 Inverting System's Background in Australia

When global warming and other global climate issues increase dramatically, new energy will gradually replace by traditional energy, which could effectively reduce carbon emissions and environmental pollution. In addition, there are abundant natural resources in Australia, such as solar, wind, tidal and so on [1]. However, new energy transferring efficiency is extremely low. In order to strengthen the utilization of new energy in factories and improve the conversion rate of new energy, the Australian government has set new energy targets to expand the utilization of renewable energy while reducing the utilization of traditional energy [1].In Australia, states and provinces have announced legislation and regulations providing incentives and funding to ensure that their objectives are achieved [1]. Moreover, the main form of converting new energy into electricity is direct current, while modern factories usually use alternating currents. Thus, an inverter power conversion device is proposed, which could convert direct current into alternating current and gradually improve the conversion rate of new energy [1].

1.2 Research Aim

The report is aimed to analyze whether the use of inverter conversion systems in the Australian power system could improve the efficiency of converting new energy sources into power sources. Besides, the report will utilize McLuhan's theory to analyze the conceptual framework and recommendations based on the problem and solution.

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2. The Description of McLuhan's Media Theory

McLuhan's media theory mainly summarizes the inevitable process of the development of the media of things and forms his theory of the media of things. Besides, the theory is mainly composed of four parts to form a media system, enhancement, retrieve, reserve and obsolescence. The following will mainly introduce the basic meaning of these four aspects [2].

2.1 Description of Enhancement

Media technology is a special process of gradually increasing the intensity so that the media surface shape changes. When the intensity of media increases to a certain degree, it will become an important factor influencing the change of media [2].

2.2 Description of Retrieve

As for retrieve, the emergence of new media technology is based on the internal characteristics of the old media, and it is a process of continuous sublimation. However, it will not be separated from the internal characteristics of the old media. Moreover, new media technology and the characteristics of the old media interact with each other so that it can be applied in the new things [2].

2.3 Description of Reverse

Concerning reverse, the new media is based on the comprehensive promotion and characteristics of the old media. When the characteristics of the old media are sublimated to the extreme, it will be reversed. Thus, it will endow the new media with new internal characteristics [2].

2.4 Description of Obsolescence

Since the emergence of new media, its typical characteristics will be superior to the original characteristics of old media in most cases, which will make the old media gradually fade out of people's sight and be eliminated and replaced by new media [2].

3. The Solution of Analysis Based on McLuhan's Theory

The inverter system is a special kind of electronic equipment system which can convert direct current into alternating current. Since the current power consumption in factories is alternating current, and the current form of new energy converted into electric energy is direct current. Thus, the inverter system is needed to improve the conversion efficiency and use efficiency of new energy. The solution will be analyzed based on McLuhan's theory [3].

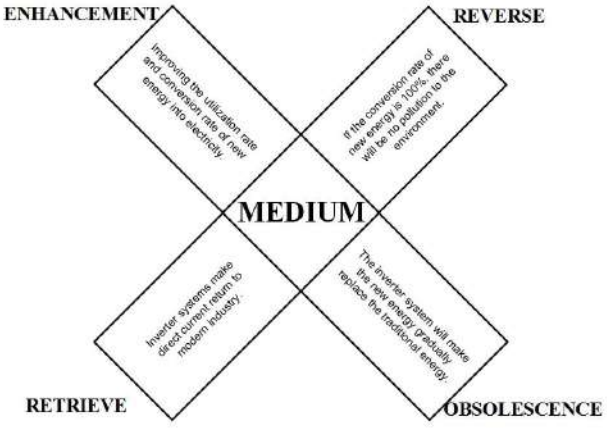

Figure 1. Visualization of McLuhan's theory

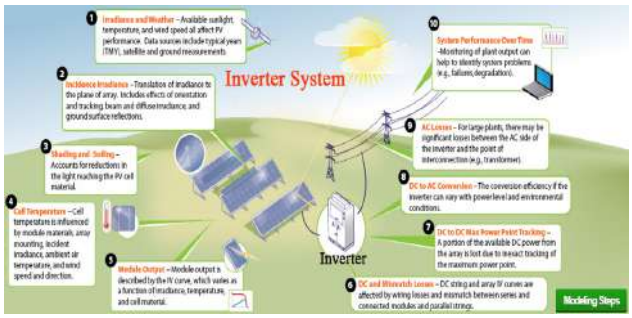

Figure 2. Inverter system schematic diagram

3.1 Analysis of Solution Using Enhancement

In Australia, factories usually use alternating current for daily production and work. Until the beginning of the 21st century, thermal power generation has been the main method to generate electricity, which is mainly through burning traditional energy. In addition, this way of power generation is highly efficiency and it causes massive pollution to the environment. Since Australia is rich in new energy, Australian engineers began to use new energy for power generation, while the power generation is very poor [3]. As the current form generated by new energy generation is mainly direct current, which cannot be directly used in factories, it only use in the residents' life. Thus, the engineers in Australia invented inverter systems that can convert direct current into alternating current, which can be used in factories. With continuously improvement and upgrade, it can be effectively used in the electricity generated by new energy in the factory, which can improve the utilization rate and conversion rate of energy [3].

3.2 Analysis of Solution Using Retrieve

In the mid-20th century, as the immature technology, fac-

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tories mainly used direct current for daily production and work. Compared with alternative current, as the development of technology, factories mainly use alternating current for daily production and work and it has become the main form of power plants [6]. In Australia, since the use of traditional energy generation, the environment is greatly damaged so that they decided to utilize new energy generation. Since the power generation of new energy is mainly direct current, the inverter systems invented by engineers are used to convert direct current into alternating current, which makes direct current return to the society with a new appearance. For this system, new energy will become the main source of power generation [6].

3.3 Analysis of Solution Using Reverse

If the power supply inverter system can convert 100% of the direct current generated to alternating current by the new energy, it can completely replace the traditional energy generation form. Moreover, traditional energy generation mainly burns fossil fuels for thermal power generation. Besides, this way of generating electricity will release a large amount of greenhouse gases and harmful gases, which could pollute the environment and do harm people's health [5]. When it can completely replace the traditional energy, we can protect the environment and guarantee people's health to the greatest extent. Moreover, the ultimate in power generation technology has changed the fundamental characteristics of the utilization of alternative current. Through the continuous replacement, the final determination of the use of direct current to alternative current power generation, which is different from the traditional alternative current power generation [5].

3.4 Analysis of Solution Using Obsolescence

With the continuous improvement of the inverter system, the efficiency of converting direct current to alternative current will be improved. As the development of science and technology in recent years, conversion efficiency has been greatly improved. Over time, engineers strive to maximize conversion efficiency [4]. In this way, new energy generation will become the main part of power generation technology, gradually replacing the traditional energy generation. In addition, traditional energy generation technologies are as obsolesces and elimination as old media. Moreover, through the upgrading of technologies, new generation technologies will keep pace with the development of The Times to ensure the timeliness of technology products [4].

4. Conclusion & Recommendations

4.1 Conclusion

In conclusion, based on McLuhan's media theory, the inverter system could improve the conversion efficiency of new energy generation from four different perspectives.

First of all, the inverter system can strengthen the new energy generated by the efficient utilization of electrical energy in the factory, improve the utilization rate and conversion rate of energy. Secondly, the inverter system can convert the direct current to the alternating current so that the direct current with a new appearance back to the factory. Thirdly, if the inverter system conversion efficiency can be achieved to the maximum, AC is the most fundamental characteristic of the change in the final determination of the use of direct current to alternating current power generation. Finally, with the continuous improvement of the inverter system and the development of science and technology, the new energy generation technology will eventually replace the traditional energy generation technology.

4.2 Recommendations

Actually, about how to promote the better development of inverter system, some recommendations will be put forward from the following perspectives.

Firstly, the Australian government needs to increase investment in the inverter systems. In addition, the new way of generating electricity requires a complete overhaul of the current generation infrastructure, which already costs quantities of money. Moreover, it will cost more than ever before to make this new, pollution-free power generation system available in the industry and in People's Daily lives [7].

Secondly, engineers and scientists need to work harder to improve the conversion efficiency of inverter systems. Also, the current technology is not yet mature so that the conversion efficiency needs to gradually reach 100% to replace the traditional power generation [8].

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ARTICLE

IoT and Machine Learning for Identifying Correlation between Factors Causing Climate Change

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ABSTRACT

The global climate is changing due to anthropogenic activities such as industrialization, infrastructure development, deforestation etc. Expected effects of climate change include increase in global temperatures, rising sea levels, changing precipitation, melting of glaciers, less snowfall, expansion of deserts etc. Most ecosystems are affected by manmade climate change and Mount Everest is no exception. This paper delves into the effects of global warming on Mount Everest and how Internet of Things (IOT) can be used to correctly monitor these effects. The IOT system will take three parameters temperature, carbon parts per million in the atmosphere and snowfall. This research paper also proposes a IOT framework to measure the net snowfall. The data gathered by the IOT system will be used to create a model will be created to monitor the effect of temperature and carbon parts per million on snow fall. .

1. Introduction

In past few decades the indicators of global warming has linked with the Everest and glaciers in mountain regions. A surface temperature reconstruction based on the response of glaciers to climate change indicates that the Himalaya and surrounding areas have warmed by approximately 0.68C since the middle of the 19th century. If current patterns keep up, most of the glaciers covering the Himalayas could melt within the next 50 years; 80 percent will be gone within 30 years [2]. Some of these glaciers are three miles long. Mount Everest would then appear as an enormous peak of mostly exposed rock with limited areas of ice. The glacier used as Hillary and Norgay's original base camp has moved three miles in 20 years while others have disappeared entirely. The rising temperatures in the Himalayas are also leading to more avalanches.

To correctly measure the effects of global warming on Mount Everest this research proposes an I.O.T Framework which will measure the annual temperature, average snowfall and carbon emission in Gokyo Region. The data collected by the system will be fed in to a prediction model which will predict the severity of the effects if current trend is to continue.

2. Factors Causing Climate Changes

This research walks through various keys which help in exploring the causes of climate change in Himalayan regions. With the factors discussed below research also discusses the correlation of these factors in causing climate change.

(1) Carbon Emission
(2) Temperature

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(3) Measure of Snowfall

2.1 Carbon Emission

6.73 percent (1,781,792) out of total population of Nepal live in Mountain region. Every year around 1,000,000 tourists visit Nepal. We can assume a high percentage of tourists visit the Mountain areas. Solukhumbu District has a total population of 105,886 [1]. The Population of Tourists *(T)* visiting Khumbu Region every year, population of Solukhumbu *(P)* is directly responsible for carbon emission. Solid waste produced by the local residents (SW_P), waste by livestock (SW_L), trekkers and mountaineers (SW_M) also causes huge amount of carbon emission. An average human exhales 2.3 pounds of carbon dioxide on an average day [3].

Considering the above elements we can define a formula to calculate *Carbon Emission (CE)* occurs in Himalayan belt:

$$CETotal = CET + CEP + CESW_P + CESW_L + CESW_M$$

2.2 Temperature

Emission of Carbon, Carbon Dioxide, other air pollutants and greenhouse gases collected in the atmosphere absorbs sunlight and solar radiation. This causes the temperature to increase. There aren't any such researches or data which has identified the shift in temperature with basis of carbon emission. With the proposed implementation model of this research the IOT Devices will help to collect the data for carbon emission and shift in temperature. With the data of sometime length collected via IOT devices our machine learning models can analysis the behavior between carbon emission and change in temperature.

2.3 Measure of Snowfall

Snowfall is a natural phenomenon. The decrease and increase of snowfall is also natural but this factor can be related with increase in temperature and the amount of carbon in the atmosphere. This can be calculated with the gradient to the point with no snow. This point will be a basis to calculate the net snowfall. The point will be x meters away from the device the initial gradient will be Θ_0. The device will be at the height of y_0 from the surface. After the snowfall the gradient will be increased to Θ_1. After the snowfall the new height will be calculated by the formula:

$y_1 = x / \tan(\Theta_1)$

The snowfall will be calculated by using the formulas:

$ds = y_0 - y_1$

$ds = y_0 - x/(\tan\Theta_1)$

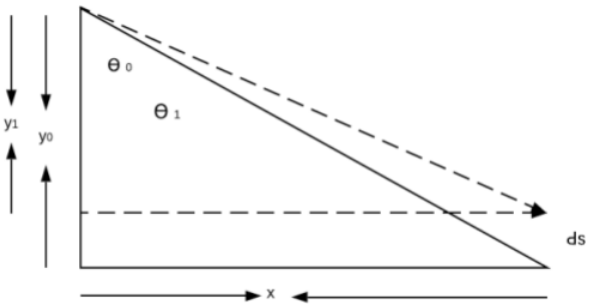

Figure 1. Measurement of Snowfall

3. Internet of Things Fundamentals

Fundamental of IOT will be highlighted in this section. The fundamentals highlighted in this section will be adapted in the development of IOT Framework. The framework will further be used to identify the correlation between factors causing climate change.

3.1 Internet of Things

IOT is an interconnected system of web enabled smart devices that collects, sends and acts on acquired data. IOT resembles the computing devices such as sensors, microcontrollers & wearables to perform in a ubiquitous environment.

3.2 Sensors in IoT

Sensors are important computing devices which enables pervasiveness in an IOT System. Sensing Layer of the IOT Architecture deals with sensors which interact in a IOT system. Sensors receives streams of data from physical world and feds those raw data to the server. Audio Sensors, Magnetic Sensors, Light Sensors, GPS Sensors, cameras, Motion sensors are some example of sensors. Carbon Emission Sensors, Infrared Sensors & Heat Sensors will be used for this research.

4. Proposed IOT Framework for Crowdsourcing Data

Section II identifies the factors and objects causing climate change. Also it describes that the data should be gathered from mountain belt as well as the residential area of Himalayan region. Framework below provides a representation of using IOT Sensors in different areas like Mountain Belt and Residential Areas. Data such as the temperature and carbon emission are received from both residential areas and mountain belt. Local residents and trekkers both emit carbon. Sensors such as infrared sensors are only

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installed in the mountain belt. These sensors will measure the difference in snow after each snowfall. Data will be gathered to a remote server via wireless sensing networks. Those data are then provided to the central storage server. At central storage machine learning algorithms will process those data for analyzing the correlation between three factors causing climate change.

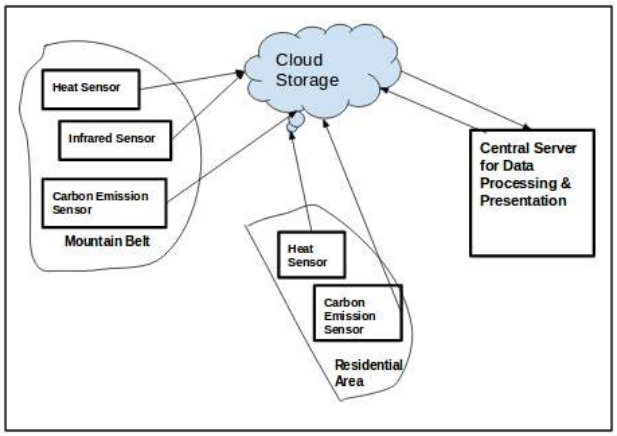

Figure 2. Proposed IOT Framework

5. Methodology

The *temperature data, carbon emission data* and *net snowfall data* gathered by the I.O.T system will be fitted in to a machine learning algorithm. The datasets will be prepared based upon the data retrieved from IOT Devices. Also a training data set will be prepared. The model will use *K-Nearest algorithm* for processing the input datasets. The 'temperature' and 'carbon emission' will be the feature to our model. The snowfall will be the label. The model will predict the average snowfall according to the temperature and carbon emission.

6. Limitations

The framework proposed in this research limits developed considering only three factors causing climate change. Due to the unavailability of research and data the framework might not suffice processing extra parameters. A detailed field study of Himalayan belt in Everest region should be done in order to estimate the field of investigation. This will then highlight the infrastructural needs for implementing the framework. The proposed framework will be implemented in the mountain region around Khumbu region. So the ideal sensors that will be used in normal experiments will lag to function up on that altitude with primitive temperature. The battery drainage will be a major problem in running the sensors always. The Machine Learning model developed is solely dependent upon the data generated from IOT Devices. Neither the IOT Framework, nor the Machine Learning Model is tested due to unavailability of data. So the accuracy of identifying the correlation between three factors causing climate change can vary.

7. Conclusion

The framework proposed for identifying the correlation between three different factors causing climate change has challenging limitations. Upon successful implementation of this framework, it can provide valuable data to different organizations such as environmental, geological & meteorological departments. Identifying the factors and their roles in causing the climate change, we can parameterize a standard for carbon emission. This can apply to the trekkers and to the local residents in limiting their use of goods that consumes high carbon. Limiting the carbon emission can help reduce the global warming.

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REVIEW

Applying Project Based Learning to Flipped Bloom Taxonomy for Deep Understanding in Control Systems

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ABSTRACT

The peculiar nature of control theory as a course that cut across a lot of major engineering disciplines calls for a look into how its learning can best be done without students feeling like they are wasting their time. This paper takes a look at control theory as subject cut across various engineering field and has a wide background that students must really be comfortable with. Its wide application and background pose a huge challenge to the teaching of control. It goes further to look into traditional method of teaching, Project - Based Learning Blooms Taxonomy. It then proposes applying Flipped Bloom Taxonomy to Project -based learning for a deep understanding of control systems. .

1. Introduction

A lot of economies around the world have transited to information and service based from the traditional industry base. Solution to multidisciplinary problems are often responsible for this shift. However, for a seamless transition to happen, there is a high demand for deep learning to happen in university education [1]. While [2] are of the opinion that 21st century competencies are deeply entrenched in creativity, [3]believes that creativity is better fostered through PBL and POPBL.

The learning of important and complex concepts and theories like control system often pose a challenge to students.

2. Traditional Way of Teaching Control

The teaching of control is traditionally structured as follows:

(1) The theoretical part including mathematical modelling, Laplace transform, transfer function, frequency response stability analysis etc. were first covered.

(2) The necessary backgrounds were covered, laying the foundation for subsequent more rigorous control topics.

(3) Few or no SIMULINK Simulators prepared by instructors are then used by students.

(4) It should be noted that the simulators do not give an actual "live" experience because simulations run in a very short period of time.

(5) Laboratory experiments that cover a limited area of study were carried out by students in a laboratory with few stations.

According to the assessment carried out by [4], they identified the following problems with this traditional ap-

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proach:

(1) The mathematics involved makes the course very demanding.

(2) Basic foundational principles are difficult to understand because the theory involved have obscured understanding.

(3) Some theoretical topics may not be necessary because they are not applied in practical implementation

(4) Few stations available for running multiple laboratory exercises

(5) Limited time to exhaust curriculum content.

Other than the problems identified by [4,5] also identified:

(1) Lack of motivation

(2) Poor background in mathematics and

(3) The wide area of application of control systems as shown in figure 1.

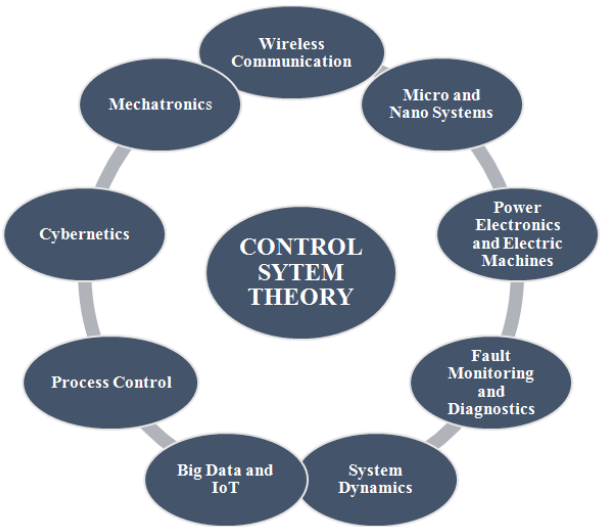

Figure 1. The wide area of application of control systems

3. Teaching Objectives

Deep learning and innovative problem solving skills are required of the 21st century engineers. [6] listed three key areas that would make this possible: theory, implementation and application.

While a strong theoretical understanding gives a firm foundation for the other two fields, if students understand the topics and how they are related, their importance and how they can impact on the development of technology, then students interest in relating to their professional responsibilities increases their motivation for deep understanding in control [7].

Implementation is another key area beside theoretical concepts. Implementation is mostly done by computers these days which make coding language vital.

The last essential part of knowledge is the proper application of learnt concepts in real-life problems. [7] indicated that their students felt that using real life scenario was not only interesting but also contributed to desire to persevere in learning and also helped in improving their programming skills.

The teaching goals identified by [6] are:

(1) deep background information,

(2) proper theoretical concept understanding,

(3) necessary tools for effecting solutions, and

(4) means of implementing course topics in real-life problems.

4. Project-Based Learning and Other Inductive Approaches

The approach normally used for instructing engineering students is mostly deductive. It graduates from general principle to specific applications. The instructor would start by teaching students the foundational materials that has to do with principles, theories, mathematical methods and historical approaches. He later gives assignments which students have to practice with; and later or much later start talking about applications.

The problem with this method of approach is in the fact that it isn't the natural way people attain and retain new knowledge, skills and expertise. Instead, people face the problem head on using residual knowledge; acknowledging more knowledge is needed, they acquire by reading, enquiring or observing the solution of similar problems and then practicing the newly acquired knowledge or skill repeatedly on the problem. People are more motivated to learn most effectively when they understand that there is an immediate need to know rather than having the need to know after four or five years. Thus teaching students inductively is a better alternative deductive approach. A lot of variations to this approach have emerged over the years, these include just-in-time learning, problem-based learning, need-to-know learning, discovery learning, and inquiry-based learning. [8]

[9] defines Project Based Learning as "a teaching method that seeks the participation of students in learning necessary and life-improving skills through a broad, student-based inquiry process designed around difficult, authentic questions and carefully designed products and tasks".

This definition is in agreement with the steps listed by [8] in the following order:

(1) Problem definition.

(2) Develop hypotheses to start the process of solution.

(3) Identify the known, what to be obtained, and what

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to do.

(4) Come up with various solutions and decide on the best approach.

(5) implement the best solution decided on, test it out, take it or leave it and go back to Step 4.

(6) Reflect on lessons learned.

[10] describe PBL as the most suitable approach to engineering education. It develops competencies, linked teaching with specialized practice. The learning scheme is based on team work, active participation and collaboration, providing different possibilities for developing technical, contextual and behavioral competences. [11] also concluded that engineering students who were taught using the PjBL approach would have a clearer picture and outlook of what an engineer is supposed to do in the workforce and directly or indirectly motivates them to study, learn and acquire the necessary 21st century skills and expertise that are essential and required by today's industries.

Obviously, straightforward deductive approach to teaching are more comfortable for instructors and student than the deductive presentation of materials. This is so for students who dread problems they have not being taught to deal with before. However, since induction is the natural way people learn, students taught this way have a better chance of mastery of knowledge and skills the instructor wishes to pass across.

5. Bloom Taxonomy

In 1956 Benjamin Bloom classified intellectual behavior in learning into levels. His objective was to advance a framework for presenting educational objectives. Bloom's taxonomy has 11 levels, which are categorized into three domains:

(1) Cognitive - this domain has skills related to how knowledge is recalled, comprehended and critically process a topic. This domain has six levels namely: Knowledge, comprehension, application, analysis, evaluation and synthesis.

(2) Affective - the way people emotionally react to other living being dominates this domain. The five levels include receiving, responding, valuing, organizing and characterizing

(3) Psycho-motor - Skills in this domain are linked to the manner in which people handle tools or appliances (such as screw driver or spanner). There were no levels designed for this level. Some levels were proposed for the domain by some researchers but there is no agreement about their usefulness.

Of all the domains, the cognitive domain received more devotion from Benjamin Bloom. It is therefore no surprise that it is the one applied the most by educators. The description of the revised model given by [12] is shown in table 1

Table 1. Revised Bloom Taxonomy levels and description [12]

Levels	Description
Remember	Relevant knowledge are recognized, retrieved and recalled from long term memory
Understand	Significant meaning from written oral and graphic messages are created through exemplifying interpreting, classifying and explaining.
Apply	Procedures are carried out by implementing or executing. Information gathered is used in another similar scenario.
Analyze	Materials are being broken into parts, how the broken parts relate to each other as well as the overall structure and purpose by differentiating, attributing and organizing is understood.
Evaluate	Judgements are made based on standards and criteria by checking and appraising. This involves justifying a decision or course of action.
Create	Assembling components together in order to form a coherent or working whole; putting elements into a new structure and pattern by through creating, planning or constructing. This involves coming up with new ideas, products and various ways of seeing things

The relationship between these levels are hierarchical in nature as shown in Figure 2. Higher levels are linked to higher complexity. Therefore, the learning process should proceed from the first (remember) level and gradually progress to the create level.

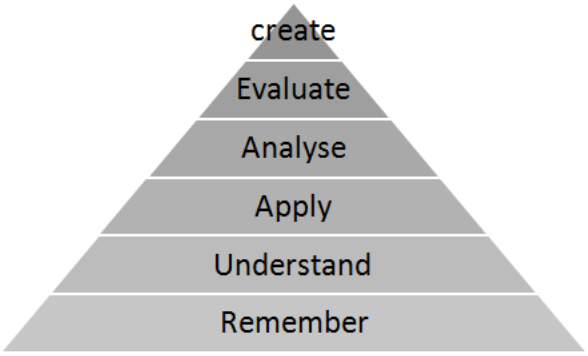

Figure 2. Hierarchical relationship among levels

6. Flipped Bloom Taxonomy

A usual engineering curriculum is dedicated to giving more time and practice in the lower levels of "remember", "understand" and "apply". Less time is giving to students to practice in the higher levels of "analyze", "evaluate" and "create". Not much is required as far as thinking skills are concerned in the lower level. However as one moves higher in the hierarchy, higher thinking skills are required in the activities involved. Higher thinking skills provide students with the arsenal to succeed in demanding and in-

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ternational engineering environment. More so, if students cannot be brought to higher levels of "analyze", "evaluate" and "create" it is very likely they will not be able to transfer what they have learnt to other situation presented in school talk less of real life scenarios. When open ended designs are presented to students, their inability to transfer classroom learning becomes evident. If student do not know in advance which set of algorithms and formulas to use and what set of assumptions could be made, even high achieving students struggle to create realistic models of the situation. Often students attempt to force fit any given data into dimly remembered equations. Reality learning can change this situation [13].

Flipped learning is another method of blended learning that use technology to stimulate learning in a classroom, this is to enable the teacher have more time to interact with students rather than lecture them on theories. In addition to this, further support is received from their peers about the activities that they are performing and what they don't yet understand [14]. Flipped learning uses a different approach of carrying out a learning process in which a student's homework is the customary practice that is worked on in class. Class time will basically be dedicated to inquiry-based learning which actually comprise what would normally be seen as a student's homework task. When the students go through the work they've done before, he looks at other areas than those worked on in class. So, with the preliminary work done at home, he would have worked on the first three levels (remember, understand, apply), meanwhile in the classroom, the more difficult levels would be practiced (analyze, evaluate and create). For teachers, using on bloom taxonomy permits them to create specific objectives in relation to which areas they want addressed or enhanced, as well as stating a learning organization that help each student to progress - from the bottom to the top of the pyramid. The instructor merely becomes a guide in the learning process while the student becomes the focus of attention, necessarily taking an active role [15].

Applying Bloom's revised taxonomy to flipped learning, students majorly work on the lower levels of cognitive work (remembering and understanding) on their own, and concentrating on the upper levels of cognitive work (applying, analyzing, evaluating, and creating) in the classroom, where they can be encouraged by their classmates and teachers [16]. The flipped idea allows a student to attain or understand the essential part of a topic, the understanding, before a session, in order that other activities, assessments and consolidation activities can build on the developing the higher skills when a teacher is present to support the student. This is comparable to the traditional method of teaching where the lower level skills are often the center of attention of classroom activities while students are left to work on the higher levels skills in their own time with homework and additional exercises [14].

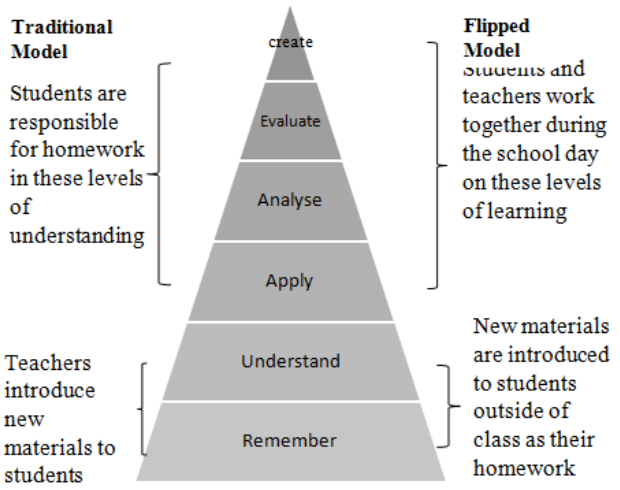

Figure 3. Flipped Blooms taxonomy model

7. Conclusion

The importance of control system is so diverse that it cannot be limited to engineering. For instance, it is profoundly fundamental in nature, human social and political organization as well as in science and philosophy of science [17]. If we limit our focus to within engineering, it is everywhere as far as technology is concerned. Aircraft and spacecraft, process plants and factories, homes and buildings, automobiles and trains, cellular telephones and networks all these lay testament to the ubiquitous nature of control system. many years of several successful applications have hardly drained the potential or importance of the field. The number and size of control conferences and journals continue to grow, new societal imperatives highlight the importance of control, and investments in control technology and technologists are taking place in old and new industrial sectors. Control is not only seen as useful for evolutionary advances in today's good, products, systems and solutions; it is also considered a fundamental enabling technology for realizing future visions and ambitions in emerging areas such as biomedicine, renewable energy, and critical infrastructures [18].

If we are to produce 21st solution providers, students of control theory must be properly thought. They must be motivated as well as know what to expect in the industry. They should be able to tackle challenges with creativity and ingenuity. Teaching control systems has to evolve and must not be left to ineffective teaching methods. For these to happen, students have to spend more time in the first

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four levels of the flipped bloom taxonomy. The "create", "evaluate", "analyze" and "apply" present the proper platform for the use of PBL. When a problem is presented, teachers can help breakdown the project into modules and theories student need to learn to solve the problem. This way students do not only learn the necessary theories needed but also come up with ways of solving similar problems and projects creatively.

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ARTICLE

The Study on Simulation of Resistance in Stall Motor

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ABSTRACT

The stall phenomenon which happens in loaded motor is unqualification in application. Meanwhile it may measure the maximum property of motor in manufacture. So the phenomenon is analyzed to find a simulation of electrical state to predict the maximum currency and torque which is a necessary method to be proceeded up to now before design. We find that the simulation fits well to the reference. The conditions of t=6s,U=12V result in the biggest stall force according to rotation to change time and voltage. Then it is t=8s,U=10V; t=10s,U=8V and t=12s,U=6V in turns. As for torque it is t=6s,U=12V; t=8s,U=10V;t=6s,U=12V and t=12s,U=6V in truns.

1. Introduction

Motor slow rotation and stall is a severe quality issue in manufacture so it is needed that we shall pay more attention to it. [1~2] When the temperature is high, the free electrons collide big with the atoms that vibrate. In virtual welding, its resistance increases and the current decreases, so its rotation decreases at the same voltage. Variable clearance of rotor and bearing will cause periodic load fluctuation, which will cause voltage decrease, and the rotation will be slow or even stop. After using the motor for a period of time, the friction of the rotor causes fluctuation, so we need to pay attention to the motor wear under the action of load will also cause stall. In the machine tool if the long time rotation produces bearing wear need to replace it immediately in order to ensure the long time use of the rotating shaft. The above is the status of stall motor. So we regulate the resistance in order to change current for observing the stall torque. But it is found that the resistance can't cause big torque or stall torque due to its weakness. This is a conclusion from this study. But the rotation is available to present a certain torque even stall torque because they are high enough. This is a new finding in this paper. So it is thought that the further research will be proceeded on this resistance later. To promote resistance and current is a way to approach the stall torque.

2. Modeling and Discussion

According to energy w defining gains

$$dW = Fds \tag{1}$$

Due to $$\frac{dW}{ds} = F \tag{2}$$

So $$P = Fv \tag{3}$$

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Here F is force; s is distance.

From electric power P and energy conservation law in terms of Figure 1 which is circuit simulation to estimate the stall status it gains

$$P = IU = I^2R \tag{4}$$

and $Pt = \frac{1}{2}mv^2$ (5)

Suppose $v = \frac{vd_0}{d_1k}$ (6)

Here k is 0.707~0.5; d_1 is armature diameter; d_0 is mainshaft diameter

From above two equations it gains the velocity

$$v^2 = \frac{2Pt}{m} \tag{7}$$

Replace (2) with (1) it gains

$$dv = d\sqrt{\frac{2I^2Rt}{m}} \tag{8}$$

Here t is time; R is resistance;m is mass of rotor.

From equation (1) and (2) gains0

$T = Fr$ false and $F = \frac{P}{v}$ (9)

Due to velocity $v = r\omega$ (10)

Gains $v = \frac{\pi dn}{60}$ (11)

from (3), (9) and (10) gains the torque T of mainshaft equation is

$$T = 9.55\frac{P}{n} \tag{12}$$

Replace above with (1) It gains the simplicity one as below

$$T = 9.55\frac{I^2R}{n} \tag{13}$$

Here n is rotation.

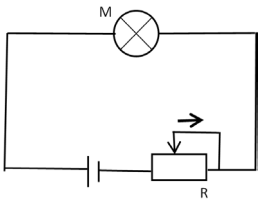

Figure 1. Circuit simulation under motor and variable resistance R

In company the motor electrical property about the stall currency is proceeded by experiment method. If they are predicted the much save will be gained. So in this paper we build the equation modeling to analyze it with different conditions. As shown in Figure 2 the result fits well with the reference practice. Two conditions are used to model the situation of practice which is stall time and voltage. Here the rotation is used to evaluate. Meantime the 6~12s(second) and 12~6V is adopted to do equation. It is observed that rotation is accession to 900rpm under t=12s,U=6V and 1800rpm under t=6s,U=12V. At last 1800rpm is acquired under t=8s,U=10V. Moreover 950rpm is gained under t=6s,U=12V at 400Ω. The highest rotation happens in t=8s,U=10V meantime the lowest one does in t=12s,U=6V. The highest is in t=8s,U=10V which results in the lowest torque to resist stall. The curve will decrease steeply after 150 Ω、200Ω and 400Ω. It expresses that the low rotation happens after these resistance.

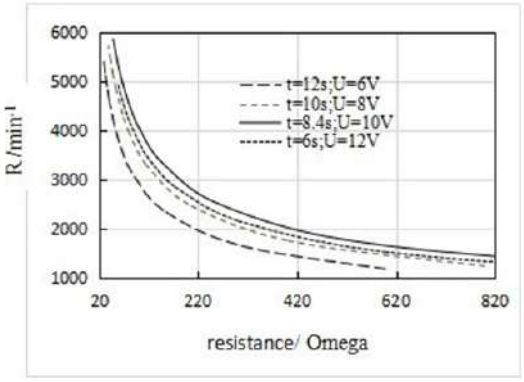

Figure 2. Relations of simulation rotation and resistance under a certain t and U

Poor voltage design in the circuit or transformer parts damage will cause the motor slow down and other phenomena. So in the design or use to ensure that the voltage is large enough. If the transformer is not used properly, the voltage will be reduced or even no voltage. These will cause the motor revolution to slow down or even stop so we need to pay attention to their voltage changes. If the voltage goes up and the current goes up the motor burns out and it's dangerous so we have to be careful about whether the voltage goes up or down. The voltage in the circuit we designed should not be too small or the rated voltage of the motor should be consistent with the design voltage. If the two do not match, the motor will burn off or stop running, be sure to attract the attention of the relevant engineer. The transformer must be precisely adjusted before it can be used for measuring and using motors. When the PLC design is electrical components damage caused by short circuit will cause the voltage increased need to pay attention to. Circuit design needs to protect

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the function of the motor, but also should be concerned about circuit short circuit and other voltage or current caused by excessive motor fault. Some circuit design is a functional role in order to make the motor to achieve the required a certain functions such as printer quickly followed suit, normal feed and fast return to demand, so the current board PLC (Programmable logic controller), PWM (Pulse width modulation), servo motor in the control of motor cycle with a certain load are prone to fatigue, leading to print qualities such as tilt up and down and not docking phenomenon.These are the side effects of motor dynamics after long-term use, belong to the motor life has reached the limit, out of service. If the equipment is new, replace the motor, but the factory needs to provide the motor. I bought a Samsung tape recorder in South Korea and after a while it suddenly stopped working. I went to the exclusive maintenance point to check that the motor burned out, a week later only to get the replacement of the motor recorder from then on no major problems.This is due to the motor that drives the tape under a certain load. In addition, the motor that drives the plasma arc furnace in the laboratory to control the speed of the circular shaft also broke down during the cycle of use, which was also caused by excessive load.The motor is a precision product made in Japan, but it also fails under the high load. Because it cannot be bought, it has to change a spare one to guarantee its use function.These are mechanical and electrical products under high voltage motor failure. So do not only seek accuracy and harm the load of this requirement, to strengthen the basic design of the motor, in the premise of ensuring the service life of the guarantee of precision. It is necessary to enhance the load and fatigue test of the motor sample, so as not to cause the shutdown within the specified period, tarnish the company's image and reduce the order quantity.

As shown in Figure 3(a~d) the torque will decrease with increasing resistance meantime it will become 0.04NmM, 0.8Nm, 1.2Nm and 0.2Nm under the different time and voltage of the above turn at 40Ω. At the t=120s and U=12V the torque will decrease at the utmost. Due to simulating stall it is limited by variable R value, so the rotation reflects this status optimum. According to rotation the resistant force is judged in this study.

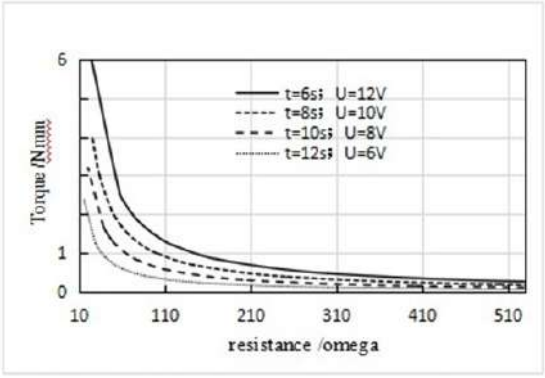

Figure 3. Relations of simulation torque and resistance under a certain t and U

3. Conclusions

The rotation can be presented a stall torque which fit to well it. It can be controlled through resistance. But the torque is too small in terms of theoretical calculation because of their weakness role. So if we promote the torque value it shall be controlled that current and voltage is main factor for further research. The conditions of t=6s,U=12V result in the biggest stall force according to rotation to change time and voltage. Then it is t=8s,U=10V; t=10s,U=8V and t=12s,U=6V in turns. As for torque it is t=6s,U=12V; t=8s,U=10V;t=10s,U=12V and t=12s,U=6V in truns.

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