YEAR: 2015- 16

ELECTROSPHERE

---- A Technical Magazine

Department of Electrical Engineering

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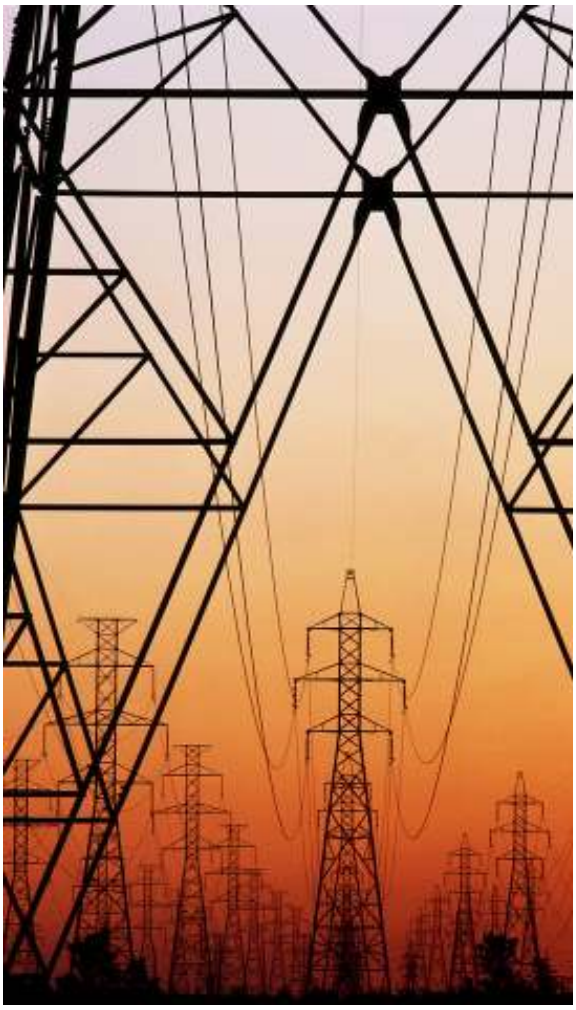
INDEX



CONGESTION IN ELECTRICAL POWER SYSTEM

- Mrs. K.S. Gadgil

The electric energy has some characteristics that require special attention. These include the inability to store energy in electrical form in any significant amounts, large daily and seasonal; variations in demand, operational requirements for power system control and reliability, and perhaps most important, the properties and limitations of the transmission system that transports electric energy from the generators that produce it to the loads that consume it. Electric energy cannot be stored. Given a set of source and destination power entry and removal sites, the ability to control which transmission paths the electric power takes is extremely limited. The physics of the

power system, governed by Kirchoff's voltage law, dictate how much of the energy being moved from one node to another travels over each of the links in the system.

Better flow control would be useful; because every link in the transmission system has a limit on the amount of power it can transfer at a given time. Several phenomena can impose these transfer limits, including thermal limits, voltage limits and stability limits.

TRANSMISSION CONGESTION

When the producers and consumers of electric energy desire to produce and consume in amounts that would cause the transmission system to operate at or beyond one or more transfer limits, the system is said to be 'congested'. 'Congestion Management', that is, controlling the transmission system so that transfer limits are observed, is perhaps the fundamental transmission management problem. 'Congestion' is a term that has come to power systems from economics in conjunction with deregulation, although congestion was present on power systems before deregulation. Then it was discussed in terms of steady state security, and the basic objective was to control generator output so that the system remained secure (i.e. no limits were violated) at the lowest cost. In the pre-deregulated power system, most energy sales were between adjacent utilities. The transaction would not go forward unless each utility agreed that it was in their best interests for both economy and security. Only when the transaction had an impact on the security of an uninvolved utility, a situation known as third party wheeling', did problems that would now be called 'congestion arises'.

In the deregulated power system, the challenge of congestion management for the transmission system operator is to create a set of rules that ensure sufficient control over producers and consumers (generators and loads) to maintain an acceptable level of power security and reliability in both the short term (real time operations) and the long term (transmission and generation construction) while maximizing market efficiency.

TRANSMISSION CONGESTION IN TWO ZONE SYSTEM

Consider a simple example of a two zone system connected by an interface, shown in Fig (a) Let each zone have a 100MW constant load, Zone A has a 200MW generator with an incremental cost of $10 / MWh. Zone B has a 200MW generator with an incremental cost of $20 / MWh. Assume both generators bid their incremental costs .If there is

no transfer limits between zones, all 200MW of load will be bought from generator A at $10 / MWh, at a cost of $2000/h as shown in Fig. 2.1 If there is a 50MW transfer limit, then 150MW will be bought from A at $10/MWh and the remaining 50 MWh must be bought from generator B at $20/MWh, thus having a total coat of $2500/h.Congestion has created market inefficiency of 25% of the optimal costs, even without strategic behavior by the generators.

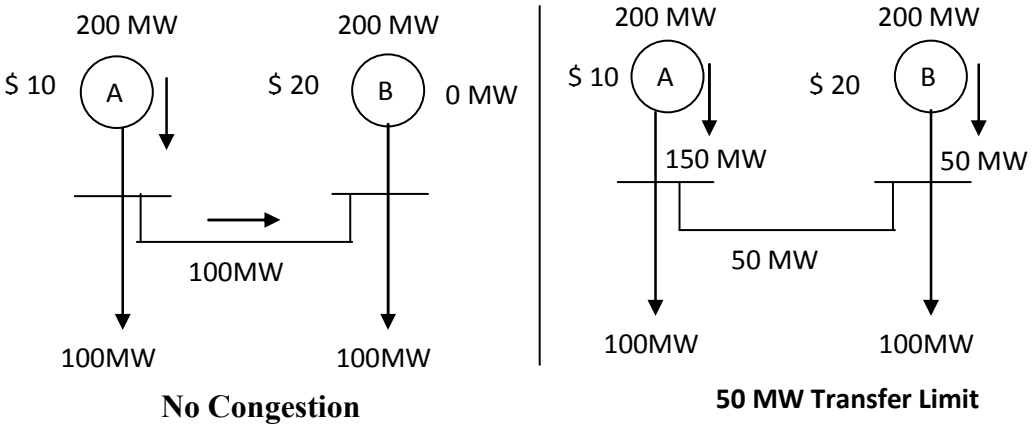


Fig (a) Two Zone System

scade

outages.

- There may be loss of load
- To schedule transmission services reliably and economically
- To check that the generation pattern does not violate the line flow limits

CONGESTION MANAGEMENT METHODOLOGIES

There are two broad paradigms that may be employed for congestion management. These are cost free means and the non-cost free means .The former include action like out aging of congested lines or operation of transformer taps, phase shifters or FACTS devices. These means are termed as cost free only because the marginal costs (not the capital costs) involved in their usage are nominal. The not – cost –free means include:

1. Rescheduling Generation

This leads to generation operation at an equilibrium point away from the one determined by equal incremental costs. Mathematical models of pricing tools may be

incorporated in the dispatch framework and the corresponding cost signals obtained. These cost signals may be used for congestion pricing and as indicators to the market participants to rearrange their power injections / extractions such that congestion is avoided.

2. Prioritization and curtailment of loads/ transactions

These models can be used as part of real –time open access system dispatch module. The function of this module is to modify system dispatch to ensure secure and efficient system operation based on existing operating conditions .It would use the dispatch able resources and controls subject to their limits and determine the required curtailment of transaction to endure un congested operation of the power system.

AVAILABILITY BASED TARIFF (ABT)

- Mrs. S. M. Shaikh

ABT regime for power trading and grid discipline was established by the Electricity Act of 2003. ABT has been implemented in the Western Region since 1st June 2002. One of the main reasons for implementing these tariffs was to encourage grid discipline by

WHAT IS ABT?

- It is a performance-based tariff for the supply of electricity by generators owned and controlled by the central government
- It is also a new system of scheduling and despatch, which requires both generators and beneficiaries to commit to day-ahead schedules.
- It is a system of rewards and penalties seeking to enforce day ahead pre-committed schedules, though variations are permitted if notified One and one half hours in advance.
- The order emphasizes prompt payment of dues. Non-payment of prescribed charges will be liable for appropriate action under sections 44 and 45 of the ERC Act. B

It has **three** parts:

- A **fixed charge (FC)** or capacity charge payable every month by each beneficiary to the generator for making capacity available for use. The FC is not the same for each beneficiary. It varies with the share of a beneficiary in a generators capacity. The FC, payable by each beneficiary will also vary with the level of availability achieved by a generator.

- In the case of thermal stations like those of NLC, where the fixed charge has not already been defined separately by GOI notification, it will comprise interest on loan, depreciation, O&M expenses, ROE, Income Tax and Interest on working capital.

- In the case of hydro stations it will be the residual cost after deducting the

variable cost calculated as being 90% of the lowest variable cost of thermal stations in a region.

- An **energy charge** (defined as per the prevailing operational cost norms) per kwh of energy supplied as per a pre-committed schedule of supply drawn upon a daily basis.

- A charge for **Unscheduled Interchange (UI charge)** for the supply and consumption of energy in variation from the pre-committed daily schedule. This charge varies inversely with the system frequency prevailing at the time of supply/consumption. Hence it reflects the marginal value of energy at the time of supply.

The UI charges are payable /receivable if

(a) A beneficiary overdraws power, thus by decreasing the frequency

(b) A beneficiary under draws power, thus by increasing the frequency

(c) A generator generates more than the schedule, thereby increasing the frequency

(d) A generator generate less than the schedule, thereby decreasing the frequency.

Thus, any of the beneficiaries get undue benefit from overdrawing from the grid; he

shall liable to pay to the affected parties at the UI rates prevailing at the point of time.

NECESSITY OF ABT

Prior to the introduction of Availability Tariff, the regional grids had been operating in a very undisciplined and haphazard manner. There were large deviations in frequency from the rated frequency of 50.0 cycles per second (Hz). Low frequency situations result when the total generation available in the grid is less than the total consumer load. These can be curtailed by enhancing generation and/or curtailing consumer load. High frequency is a result of insufficient backing down of generation when the total consumer load has fallen during off-peak hours. The earlier tariff mechanisms did not provide any incentive for either backing down generation during off-peak hours or for reducing consumer load / enhancing generation during peak-load hours. In fact, it was profitable to go on generating at a high level

even when the consumer demand had come down. In other words, the earlier tariff mechanisms encouraged grid indiscipline.

The Availability Tariff directly addresses these issues. Firstly, by giving incentives for enhancing output capability of power plants, it enables more consumer load to be met during peak load hours. Secondly, backing down during off-peak hours no longer results in financial loss to generating stations and the earlier incentive for not backing down is neutralized. Thirdly, the shares of beneficiaries in the Central generating stations acquire a meaning, which was previously missing. The beneficiaries now have well-defined entitlements, and are able to draw power up to the specified limits at normal rates of the respective power plants. In case of over-drawal, they have to pay at a higher rate during peak load hours, which discourages them from overdrawing further. This payment then goes to beneficiaries who received less energy than was scheduled, and acts as an incentive/compensation for them.

HOW DOES IT BENEFITS EVERYONE?

The mechanism has dramatically streamlined the operation of regional grids in India.

Firstly, through the system and procedure in place, constituents' schedules get determined as per their shares in Central stations, and they clearly know the implications of deviating from these schedules. Any constituent which helps others by under-drawal from the regional grid in a deficit situation, gets compensated at a good price for the quantum of energy under-drawn.

Secondly, the grid parameters, i.e., frequency and voltage, have improved, and equipment damage correspondingly reduced. During peak load hours, the frequency can be improved only by reducing drawls, and necessary incentives are provided in the mechanism for the same. High frequency situation on the other hand, is being checked by encouraging reduction in generation during off-peak hours.

Thirdly, because of clear separation between fixed and variable charges, generation according to merit-order is encouraged and pithead stations do not have to back down normally. The overall generation cost accordingly comes down.

Fourthly, a mechanism is established for harnessing captive and co-generation and for bilateral trading between the constituents.

Lastly, Availability Tariff, by rewarding plant availability, enables more consumer load to be catered at any point of time.

The unique feature of this tariff, to tackle the peculiar problems of grid operation in India, is the frequency-linked pricing of the Unscheduled Interchange (UI) based on a novel concept proposed in 1984 and developed over the years by Bhanu Bhushan. He also specified the special energy meters (a pre-requisite for implementation of this mechanism) in 1991, and guided their indigenous development.

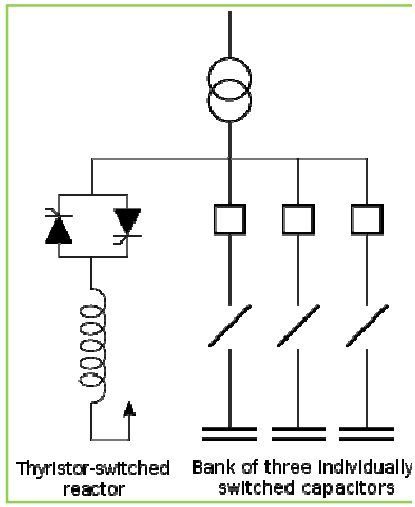
Thus, Electricity Act 2003 and Availability Based Tariff (ABT) have been the two important pillars to bring about deregulation in the electrical industry in India.

STATIC VAR COMPENSATOR FOR ENERGY CONSERVATION

- Sachin V Shelar

n an electrical power system it is essential to balance the supply and demand of active

and reactive power. An ideal power system has to ensure power supply at a constant voltage and frequency, free from harmonics with unity power factor at every supply point and at the consumer's loads. However, in practice this is not possible to achieve due to characteristics of the consumer's load. Also with the increase in the application of electrical power to sophisticated applications such as computers, electronic devices, space research etc. the need for maintaining quality and reliability of supply has assumed great importance. To achieve all the above objectives, one of the most important factors is the control of reactive power. This will also save lot of energy.



The Static VAR Compensator (SVC) is an early generation FACTS device and a proven technology for voltage stability and power factor correction. Traditionally the SVC is a shunt connected device consisting of two branches – the TSC (Thyristor Switched Capacitor) branch generates reactive power and the TCR (Thyristor Controlled Reactor) branch absorbs reactive power. The coordination of two branches works to balance the reactive power absorbed by or generated by the SVC, thus providing load power factor correction and it maintains unity power factor.

Recognizing the importance and need of reactive power compensation and energy conservation, power utilities have started giving incentives to encourage customers to maintain power factor as high as possible, ideally unity. Customers are also concerned with minimizing their costs due to high tariffs and stiff competition; also they are concerned with the efficiency of the system. Thus shunt

compensation is a must for maintaining good power factor. The options available to the customer are installing fixed shunt capacitors or more sophisticated option is to go for Automatic Power Factor Correction (APFC) system. However, as customers' load changes continuously so the reactive power demand also varies from time to time. Fixed capacitor does not give proper solution as it gives under or over compensation depending upon the load. Hence APFC system stands better than fixed capacitors since it senses the demand and corresponding power factor of load to calculate the KVAR requirement. But still KVAR support from APFC system comes as step function and many times it cannot maintain unity power factor. Further there are certain limitations of APFC system such as maximum number of steps, maintenance, restriction on time to re-switch the switched off capacitor bank etc.

STATIC-VAR COMPENSATOR

According to the Task Force of the Flexible AC Transmission Systems (FACTS) Working Group of the DC and FACTS Subcommittee, [4] Static VAR Compensator (SVC) is defined as "A shunt connected static VAR generator or absorber whose output is adjusted to exchange capacitive or inductive current so as to maintain or control specific parameter of electrical power system"

SVC – Static VAR Compensator –

is advanced power equipment, which provides fast and continuous capacitive and inductive reactive power to the power system. Reactive power to a network is supplied by capacitors, which act as local generators of reactive power. A capacitor gives a step function and is not linearly variable, whereas an inductor is linearly variable whose magnetic field can be

regulated. In practice, a combination is achieved in such a way that the resultant KVAR – capacitive which will make power factor unity, can be fed into a network in a linearly regulable fashion. Combination can also feed a resultant inductive KVAR. SVC uses static electronic switches (thyristors) replacing mechanically operated circuit breakers. A SVC controller continuously scans the power factor of the system and accordingly switched on the required capacitors and if required it trims the extra KVAR by introducing inductor by firing thyristors. Thus it does VAR compensation with the help of static switches and hence the terminology - Static VAR Compensator.

The advantages of SVC are -

- Fast power factor control.
- Reduction in current.
- More system capacity.
- Small Physical Size.
- Flexibility of location.
- Comparable economics.

The exponential rise in demand and inability to generate power to cope up with the demand has posed many problems before the utility. Out of number of solutions possible the easiest to implement is to utilize the available power optimally i.e. improve the power factor, ideally to unity which is a major part of energy conservation. To do so, the electricity act 2003 made a special provision by giving incentives to the consumers in terms of rebate in the bill. Conventional methods of compensation such as fixed shunt capacitors and APFC panel are not effective in maintaining unity power factor. SVC seems to be a practical solution to address the above problems.

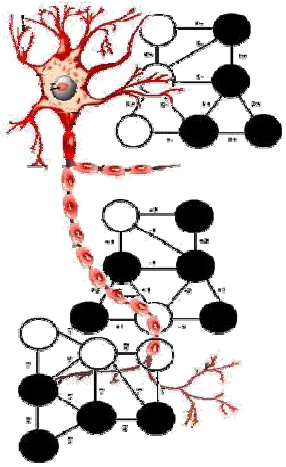
ARTIFICIAL NEURAL NETWORK

-.Mrs. V.P Kuralkar

WHAT IS A NEURAL NETWORK ?

Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information.

The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly



WHY USE NEURAL NETWORKS

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. Other advantages include:Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.

NEURAL NETWORKS VERSUS CONVENTIONAL COMPUTERS

Conventional computers use an algorithmic approach .Unless the specific steps that the computer needs to follow are known the computer cannot solve the problem. But computers would be so much more useful if they could do things that we don't exactly know how to do. Neural networks process information in a similar way the human brain does.. The disadvantage is that because the network finds out how to solve the problem by itself, its operation can be unpredictable.

ARCHITECTURE OF NEURAL NETWORKS

FEED-FORWARD NETWORKS

Feed-forward ANNs (figure 1) allow signals to travel one way only.Feed-forward ANNs tend to be straight forward networks that associate inputs with outputs. This type of organization is also referred to as bottom-up or top-down.

FEEDBACK NETWORKS

*F*igure 1 can have signals travelling in both directions by introducing loops in the network. Feedback architectures are also referred to as interactive or recurrent, although the latter term is often used to denote feedback connections in single-layer organizations.

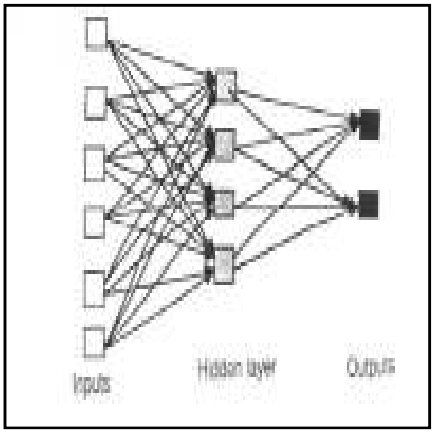


Fig4.1:An example of a feed-forward network

including: sales forecasting ,industrial process control ,customer research ,data

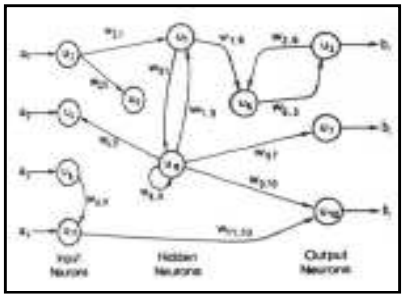


Figure 4.2 An example of a complicated network

CONCLUSION

The computing world has a lot to gain from neural networks. Their ability to learn by example makes them very flexible and powerful. There is no need to understand the internal mechanisms of that task. They are also very well suited for real time systems because of their fast response and computational times which are due to their parallel architecture. Neural networks also contribute to other areas of research such as neurology and psychology. Finally, We would like to state that even though neural networks have a huge potential we will only get the best of them when they are integrated with computing, AI, fuzzy logic and related subjects.

DATA COMMUNICATION PROTOCOL- RS 232 and RS 485

- Mrs.A.D.Shiralkar

The word communicate is illustrated as an act of passing of news, information, feelings, heat, motion, etc in its electrical sense. For an electrical engineer, the term communication refers to the sending reception and processing of information by

electrical means e.g. voltage, current and this can be achieved through wire conductors.

Processed information about the parameters like level, temperature, pressure, heat, density, flow-rate, etc. is data.

If we consider present scenario of industrial developments, data communications plays very important role and data communication process is

become more and more important. Intensive competition is forcing industry to introduce greater efficiency and more flexibility into plant processes. This includes greater plant flexibility in order to meet the changing demands of the customer. Due to relatively high operating capacity and operation can be maintained in today's industrial countries. Traditional concepts of plant design, commissioning and operation are being very closely examined. An important part of this examination is instrumentation at field level, at control room and quality of communication between field and control room devices.

Moreover, today's microprocessor technology makes sensors not just more and more intelligent. They do not just after the measured values with high accuracy, but because of their intelligence, self check is possible. The initial signal is processed or even control capabilities are delegated to the intelligent field device. As a result of more requirements are needed in data communication among the intelligent devices forming the automation system. Bi-directional data transmission is required. Smart technology is a first step towards field communication.

BASIC REQUIREMENTS OF DATA COMMUNICATION BUS:

Field bus is the ultimate solution to integrate intelligent sensors and devices with control system architecture .

The communication bus carrying or exchanging the data between different intelligent devices should fulfill following basic requirements.

Data Corruption should not be there that is data communication bus should be such that it should not be affect by external noise on data e.g. If high power cable is passing with signal cable, there should be affect of magnetic field developed by power on data.

Data Security: There should be facility to check the

exchanged data means the cross check facility to check whether the received data is same as the transmitted.

Less Cable Requirement : To cater the requirements of customers, cost is the major factor to be considered in today's competition. So automation system one such designed that it should fulfill at the requirements. As a result, data communication bus should be able to exchanging all information with less cable and cabling requirements. It means that it should be cost effective.

If we consider the cable and cable laying cost between field device and control room devices, serial communication is cheaper as comp aired to parallel communication, we have to lay different cables for data communication. But in serial communication single bus carry all the parameters information.

PROTOCOL

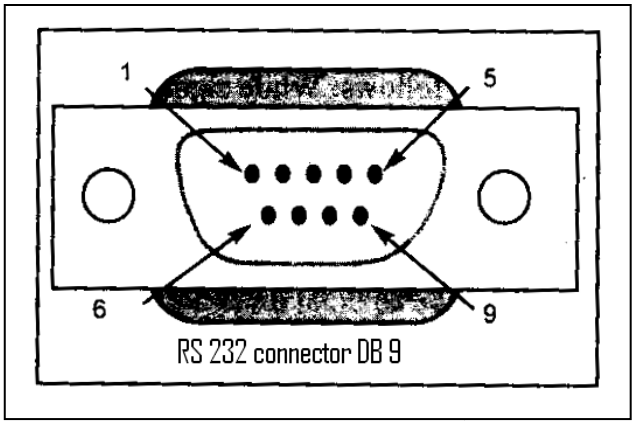
In order to interconnect the various types of intelligent devices supplied by different manufactures or interconnect the devices in a distributed data processing system, international standers are developed. The international Organization for standardization (ISO), a voluntary association of national standards bodies, and the Consultative Committee for International Telephony and telegraphy (CCITT) are current defining a hierarchy of co-ordination procedure for interconnecting computers, computers to terminals, terminals to terminals. Such a standard defines a set of conventions governing the format and relative timing of massages to make communication possible between different intelligent devices is called protocol.

RS-232 PROTOCOL

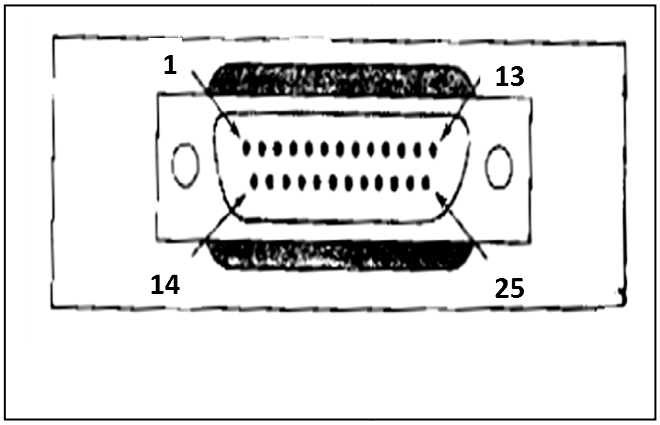
The first level protocol standard commonly in use in all industries to connect computers, business machines, multiplexers to data sets of intelligent devices is EIA RS 232- C standard. This is developed

for serial binary data communication.

RS 232 standard also specifies the mechanical connector type 9 pin and 25 pin connectors are the most common plug and socket associated with the RS 232. The required pin connections of these connectors is also decided and kept as standard as below:



RS 232 Connector DB -9



RS 232 Connector DB -25

For 9pin D type connector

Pin No 2- Transmitted data.

Pin No 3 – Received data.

For 25 pin D type connector

Pin No 2- Transmitted data.

Pin No 3 – Received data.

Two of the real drawbacks of the RS 232 –C standard are limited data transmission rate of 20kb/s and the 15m cable length. The unbalanced nature of circuitry employed is the main cause for this. Although balanced lines in which one line is kept at ground are the most common, the trend is towards a balanced that is to use RS 485.

SHORTCOMINGS OF EIA/RS 232:

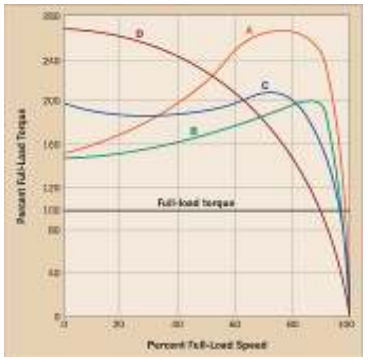
RS 232 is commonly used to connect devices in industrial

applications for example; RS 232 is often used to connect an MMI Computer to a PLC or Devices to a remote event printer. But RS 232 suffers

scalar and vector control. In scalar control, which is based on relationships valid in steady state, only magnitude and frequency of voltage, current,

scalar control, which is based on relationships valid in steady state, only magnitude and frequency of voltage, current, and flux linkage space vector are controlled. In vector control, which is based on relations valid for dynamic state, not only magnitude and frequency but also instantaneous position of

control of Induction Motor is more complex than the control of DC motor. This



DIRECT TORQUE CONTROL OF INDUCTION MOTOR

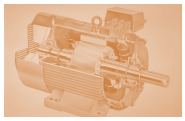
- *By Prof.V. S. Kamble*

The induction motor along with variable frequency AC inverters, are used in many adjustable speed applications which development of powerful switching component and efficient control techniques. Induction motor control methods can be divided into scalar and vector control. In

voltage, current, and flux space vector are controlled.

INTRODUCTION

The industry is becoming increasingly concerned about the ability of motors to ride through power system disturbances. The majority of motors in the field are induction motors. The



complexity is increased substantially if high performance is demanded. The

main reasons of this complexity are the need of variable frequency, harmonically optimum converter power supplies, and the complex dynamics of induction motors, parameter variations and difficulties of processing feedback signals.

MODELING OF INDUCTION MOTOR

The dynamic behavior of an induction motor is complex due to the coupling effect between the stator and rotor phases. Therefore, it is more convenient to analyze the induction machine in terms of space-phasor quantities. A few assumptions are adopted to simplify the analysis, which will not affect the validity of the developed model. The assumptions are as follows

1. The effects of slotting iron losses and end-effects are neglected.

2. The permeability of the iron parts is infinite.

3. The flux density is radial in the air-gap.

4. A smooth-air-gap with the winding on the stator is symmetrically distributed such that the spatial mmf produced is sinusoidal.

5. The rotor is of a squirrel cage type.

DIRECT TORQUE CONTROLLER FOR INDUCTION MOTOR

The basic principle of DTC is the direct selection of a space vector and corresponding control signals, in order to regulate instantaneously the electromagnetic torque and stator flux magnitude.

CONVENTIONAL DIRECT TORQUE CONTROLLER

Conventional direct torque controller mainly consists of two level hysteresis comparator for calculating stator flux error and three level hysteresis comparator for calculating electromagnetic torque error. After determining the stator flux error and electromagnetic torque error the proper state of voltage vector is selected. For finding out the errors of stator flux and electromagnetic torque the proper estimation of stator flux

and electromagnetic torque is necessary.

Stator Flux Control

In order to exactly calculate the stator flux error, an accurate estimation of stator flux is must. There are two most popular model used to estimate the stator flux, namely the stator voltage model and current model. The estimation is based on an open-loop integration of the stator back emf and requiring only stator resistance, stator current and voltage. It provides an accurate stator flux estimate at high speeds. However at low speed, the stator resistance drop becomes significant causing inaccurate estimation. Consequently, the voltage model is generally not capable of achieving high dynamic performance at low and zero speeds.

The magnitude and orientation of the stator flux must be known in order to directly control the stator flux by selecting appropriate voltage vector. It is proposed that the stator flux plane is divided into six sectors. Each sector will have a different set of voltage vectors to increase or decrease the stator flux. The stator flux is forced to follow the reference value within a hysteresis band by using a two-level hysteresis comparator.

The estimated stator flux is subtracted from the corresponding reference values to obtain the error, which is then fed to the hysteresis comparator. The hysteresis comparator will produce flux error status, which can be either 1 (positive error) or -1 (negative error).

Electromagnetic Torque Control

In DTC, the torque is controlled within its hysteresis band similar to the stator flux. Three-level hysteresis comparator is employed because the motor may operate in motoring mode as well as braking mode. DTC allow induction machine operates in all four-quadrant of its torque-speed plane. In forward motoring mode (Quadrant 1), when the torque increases and reaches the upper band, it is better to decrease the torque as slowly as possible to reduce the inverter switching frequency. In this case, zero voltage vector is preferable than the radial voltage vector to reduce the torque. In order to increase the torque when it touches the lower hysteresis band, active forward vector will be applied. However, when the motor is forward braking (Quadrant 2), a reverse voltage

vector will be selected when it touches the upper band. Zero voltage vector is applied when the torque reaches the lower band. For clockwise rotation, the zero voltage vector instead of active voltage vector will be selected to increase the torque in braking mode. In Quadrant 3, when the motor is in reverse motoring mode, the reverse voltage vector rather than zero voltage vector is chosen to increase torque. Two assumptions are made, which are the motor is rotated in counter-clockwise rotation and the load torque is constant. When a negative reference torque is applied, the motor is in braking mode; hence the torque error status alternates between −1 and 0. When the torque reference is step up to positive, the torque error status will switch between 1 and 0, indicating that the operation is in motoring mode

Switching Selection

Due to the decoupled control of torque and stator flux in DTC, a high performance torque control can be established. If the stator flux lies in sector k with the motor rotating in counter clockwise, active voltage vector VS,k+1 is used to increase both the stator flux and torque. Voltage vector VS,k+2 is selected to increase the torque but decrease the stator flux. The two zero voltage vectors (VS,7 and VS,8) are used to reduce the torque and at the same time, freezes the stator flux.

Reverse voltage vector VS,k-2 is used to decrease the torque and flux in forward braking mode. Whereas VS,k-1 will reduce the torque and increase the flux.

The optimum selection of the switching vectors in all sectors of the stator flux plane can be tabulated in the so-called optimum switching vector selection table given by Table 1. This table is used to select the voltage vectors depending on flux error, torque error and the stator flux orientation [1-2].

Switching Frequency

The switching state of the inverter is updated in each sampling time. Within each sampling interval, the inverter keeps the state until the output states of the hysteresis controller change.

Variable switching frequency may produce significant acoustic noise of variable intensity, a non-uniform distribution of switching losses for each semiconductor switch in the power inverter and currents that have nondeterministic harmonic content. Basically, they can be divided into hysteresis based and non-hysteresis based solutions. Variable hysteresis band comparator was proposed

Error		Sector					
Flux	Torque	1	2	3	4	5	6
1	1	V2	V3	V4	V5	V6	V1
	0	V7	V8	V7	V8	V7	V8
	-1	V6	V1	V2	V3	V4	V5
-1	1	V3	V4	V5	V6	V1	V2
	0	V8	V7	V8	V7	V8	V7
	-1	V5	V6	V1	V2	V3	V4

where the band can be adjusted to fix the switching frequency. The proposed switching frequency regulation strategy is based on a clocked commutation technique developed for switching frequency in a hysteresis current controller.

SIMULATION RESULTS

Computer simulation of Induction Motor for Direct Torque Control is attempted in MATLAB environment. The

model has described the Torque response with variable reference value at the same time the effect on Stator Flux and Stator Current is also observed with Direct Torque Controller. The results of torque, stator flux locus and stator current are obtained in the form of graphs.

Simulation with Conventional DTC.

Simulation of the developed model is done with a Flux reference value of 0.8 and variable Torque reference value as (7-10-5) with time specification of (0-0.1-0.2) is done with conventional DTC. Figure 1 to Figure 3 shows the

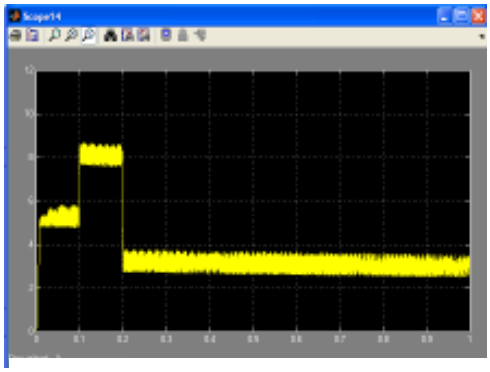


Fig 1 Torque response obtained using conventional DTC

Figure 1 shows the Torque response which is less than the reference with some ripples. Figure 2 shows the locus of Stator Flux. From which it is observed that the value of Stator Flux decreases between the sectors. The IM takes high current initially and then it becomes a sinusoidal. The current remains constant during constant Torque reference.

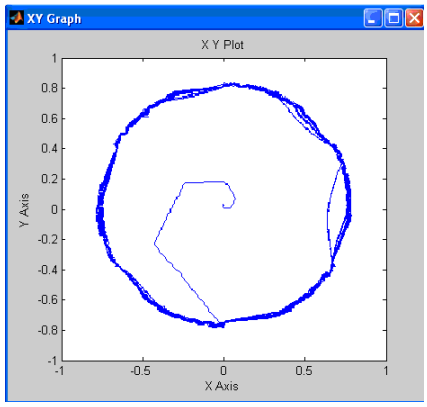
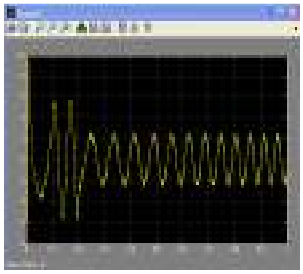


Fig 2 Stator flux locus conventional DTC using

Fig3 Stator Current using conventional DTC

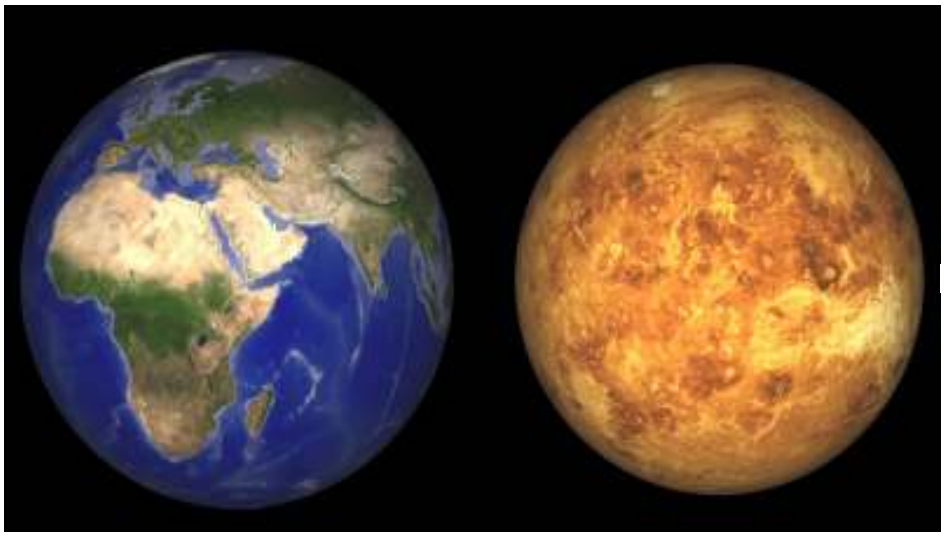
CONCLUSIONS

This paper has presented improvements on DTC of induction machine drives. A brief introduction of the



QUESTION OF 1 ^{O}C-POINT OF NO RETURN (GLOBAL WARMING)

- Kulkarni Anurag (BE Electrical)



Runaway, global warming effect 'researched by experts is most probably going to true. Uncontrolled emission of green house gases impacted to raise earth temperature 0.20/decade. Up to date earth temperature is 14.8˚C, recorded highest in last one million years. If now earth temperature raise to 10 ˚C from 14.8˚C then global warming can't controlled by any human efforts— cause nature will help to do it, no new coming technology or technique can break this effect. Earth may become like Venus which is best example of green house effect.

Let's comparatively see birth and dimension of earth and Venus. Earth diameter is 12,756Km and that of Venus is 12,102Km, no much more density difference, earth has 5.5gm/cm^3 and Venus have

5.2gm/cm^3. Only 8% difference in gravitational force, both have born at same time.

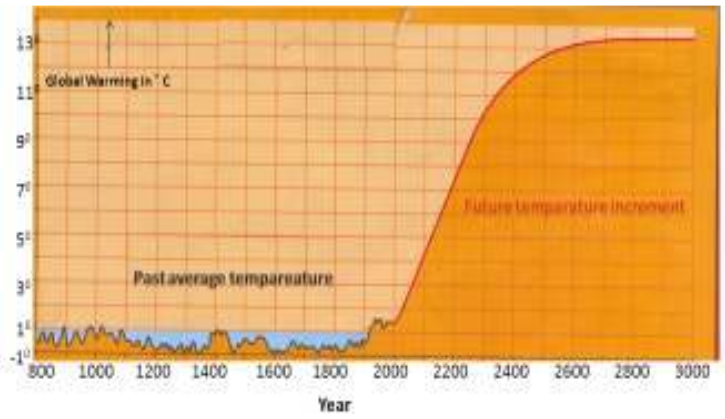
But now however Venus has climate that no life can immerse. Surface temperature is 470˚C, atmospheric pressure is 90 times more than earth. Whole planet is clouded by sulfuric acid. Acid rain falls throughout year, no one drop is reaching to surface. Thousand of lightening occurs in a minute. Hence if something remaining, cyclone does it. Cyclone gets fly up at speed of 350Km/h. Such a cyclone completes planet round in only four days.

At the beginning of birth, both earth and Venus had same life. But Venus was not like what it is now. At the life starting both planets had smoked million tons of CO2 and water vapors through volcano. Condense gases caused rain fall or thousands of years. This continues process created ocean on both planet. Both have parallels same life.---but now earth survived and Venus not. Why.....

Let us talk on CO_2 and water vapor on earth, all the smoked CO_2 and water vapor has not vanished today, not gone anywhere but billion tons of CO_2 is adopted by ocean as lime, some of them are converted to marbles. Plants have also utilized.

But on the Venus side, ocean in plant does not sustain because sun at that time was 70% energetic than now. As a Venus is closer to sun ocean evaporation goes on rapid process. The surface area was filled up with water vapor .Therefore atmospheric pressure and density of Venus raise up. This process was preventing further evaporation of water. And ocean had not been evaporated fully. Water remained in liquid state for millions of year during this period smoked CO_2 from volcanoes began to show their greenhouse effect. If before this Venus would have plant then this will not happen. But time was not so sufficient to grow planet. Continuous emission of CO_2 from volcanoes causerising up processing greenhouse effect. This caused ocean to evaporate surface temperature reach o 370˚C at this temperature no drop of water will remain at liquid state and water vapor helped to rise greenhouse effect causing more rising temperature. This process is known as RUNAWAY process.

Country	Per Capita Consumption (kwh)	Per Capita CO_2 Emission (Tones)
UAE	**16,161**	**29.91**
Sweden	**15,238**	**5.05**
USA	**13,616**	**19.10**
Australia	**11,216**	**18.75**
Japan	**8,475**	**9.68**
Germany	**7,185**	**9.71**
China	**2,328**	**4.57**
World Average	**2,752**	**4.38**
India	**543**	**1.18**
Indonesia	**564**	**1.67**
Global Electricity Consumption And CO_2 Emission(Year 2007)		
(Source: Key World Energy Statistics, IEA,2009)		



Worse case is to be noted about CH4 gas. It will be 20times cuprites than CO_2 .Today's greenhouse effect consists 50% of CO_2 only.

Why 1˚C border limit to earth temperature?

Start with smoked fossil fuels by human being, up to date human has emitted so much of greenhouse gases.5000billion tons steel remains.

From 1000s of years human have been utilizing fuels and continuously raising it.

This will cause average 10 of rising temperature before 2020.This point is said to be point of no return. cause no0 human efforts after death will stop this RUNAWAY process.

How it going to proceed?

Ocean have adapted millions of $CO_2$and continuous to do. Now let us take best example of any carbohydrate soft drink. When it is chill its CO_2 remains within it. But when it exposed to

POWER GENERATION USING GEOTHERMAL ENERGY

-Patil Pranav Pandit (BE Electrical)

The alternative energy source, Geothermal Energy deals with the energy generation from the heat available in the earth's crust. On worldwide basis, geothermal energy is considered to have the largest technical potential of the renewable energy sources. It is being proposed that still 80% more of this energy can be extracted so the worldwide energy crisis can be overcome. This thermal energy available deep down the ground can be used to power the electricity generation equipments.

The paper intents to give the explanation of the geothermal energy resource, its exploration and its utility in power generation. It flashes light on Hybrid power plants and Enhanced geothermal system i.e. EGS. It presents the inquisitiveness of the study and exploration of Geothermal Energy for the generation of electricity.

Keywords –Geothermal energy, Electric generation, Hybrid Power Plant, EGS.

Today, the energy consumption covers wide uses in domestic and industrial areas. Fossil fuels which provide the major part of energy are on the way of depletion. The best way is to harness the available resources in nature to optimum level. For this, the renewable sources can be the best alternatives as they can be replenished in a short period..

Geothermal Energy is one such alternative source having great potential.

B Geothermal Energy Source.

The nomenclature Geothermal comes from Greek words Geo (Earth) and Therme (Heat).

Geothermal energy is renewable energy source because the heat is continuously produced inside the Earth. We can recover

this heat as steam or hot water.

USE OF HEAT FROM THE EARTH

There are four main types of geothermal energy resources:

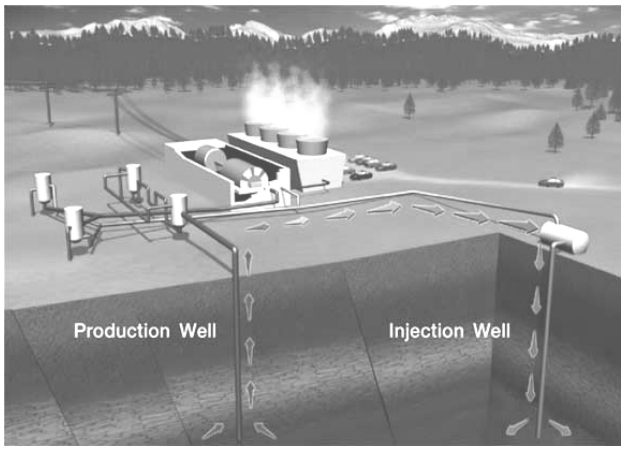
1. Hydrothermal
2. Geopressurized brines
3. Hot dry rocks
4. Magma

USE OF GEOTHERMAL ENERGY FOR

The various stages for the generation of electricity by geothermal source include:

A. Survey

B. Mining and DrillingC. Generation of power



Geothermal Plant Layout

TYPES OF GEOTHERMAL PLANTS

A. Dry Steam Plants

B. Flash Steam Plants

C. Binary Cycle Plants

SCOPE OF GEOTHERMAL ENERGY

A. Worldwide Scope

It is expected that power generation can go up to 15,000 MW which will contribute about 8,000KW more power per year in U.S.A.

B. Scope of Geothermal energy in India

The GSI (Geological Survey of India) has identified 350 geothermal energy locations in the country of moderate and low temperatures. The most promising of these are:

- Puga valley of Ladakh
- West cost of Maharashtra and Gujarat
- Tattapani in Madhya Pradesh

HYBRID POWER PLANT

In many regions the temperature of geothermal brine that can be tapped in natural reservoirs generally stays below 120°C.

Especially in India, the hybrid concept can be implemented as due to low temperatures of geothermal reservoirs projects wouldn't be profitable being based on geothermal energy only.

EGS: ENHANCED GEOTHERMAL SYSTEMS

The scope to find natural geothermal resource is limited to only certain regions. To overcome this, the idea of EGS has been implemented.EGS stands for Enhanced Geothermal System. EGS are a new type of geothermal power technologies that do not require natural convective hydrothermal resources.EGS makes the use of supercritical CO2, instead of water.

APPLICATIONS

- Generation of electricity.
- In industrial process heating.
- Space heating for various kinds of buildings.
- In mineral extraction.
- Also in aquaculture, agriculture and industrial uses.

ADVANTAGES AND DISADVANTAGES

A. Advantages of geothermal energy

- Operational flexibility,versatile in use,least polluting
- It delivers greater amount of net energy, production price of geothermal energy is favorable
- Several wells can be drilled in the geothermal field to obtain high flow rate.
- Useful minerals can be extracted from ground water.
- Emit very much less CO2, SO2 and no Nitrogen Oxide
- Electricity generated from geothermal energy saves around 85 million barrels of fuel from being burned worldwide. This prevents 42 million tons CO2 being emitted to the atmosphere.

Disadvantages of geothermal energy

- Overall efficiency for power production is low.
- The withdrawal of fluid may result in surface subsidence.

- Drilling operation is noisy, larger areas are needed for exploitation

YEAR : 2015- 16

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