ABSTRACT

The necessity of requirement of development of human race has evolved many technologies in various sectors and fields, which contribute to mankind in various ways. In that way one technology is in transportation field. The transportation in today world can be considered as mainstream and one of the most viable inventions for mankind.

The vehicle constitutes the important part in transportation sector and mostly they run on the fossil fuel which is a natural resource and it amounting is fixed on the earth. Beside it there is another flaw they create much pollution which is hazardous for environment and for living creatures on the earth. The pollution is becoming global issue, which required urgent attention for its remedy.

Therefore, considering both the aspects said above there is demand for technology which is clean and efficient and also capable of fulfilling the requirement of transportation. So, here comes the introduction of electric vehicle. Therefore here I have tried to introduce design and modeling of EV by different electrical sources. The main challenge in EV is the storage of electrical energy. The electrical energy can be stored only in DC. In EV there will be no physical contact with conductor while moving as in electric locomotives; therefore there is requirement of storage of electrical energy in form of DC. The most demanded storage medium is Battery. There are different types of batteries but for the purpose of EV the battery should have high energy density, high Ah (ampere-hour) rating and good durability. By going through various batteries technology Li-ion (Lithium –ion) battery gives promising solution for EV. The battery is required to be charged at frequent interval after its energy is utilized and the potential across terminals reduces that it become discharged battery and then it is off no use, therefore there will be requirement to charge the battery and for that we need a static changing point of AC or DC o/p terminals. Then the battery of vehicle will get charged and will become useful again to drive the vehicle. In charging it takes long time and in very short range of drive the battery SOC will drop to the value where it become unusable. To overcome this problem we can use different types of other electrical source to unify in a single system to get a long range of drive with better performance. The fuel cells can resolve the issue of battery

satisfactorily. Basically the fuel cell do not store the electrical charge directly but when chemical reaction of hydrogen and oxygen is done in it then charge is generated which creates potential across the terminals and thus we can extract electric power from it. Basically here the hydrogen is to be stored for functioning of fuel cell so it can be considered as indirect method of storing of electric energy. As the hydrogen has high power to weight ratio so equivalently it has much higher storage capacity than battery.

The two sources discussed above have one common problem that there time response in transients is sluggish and in vehicle as there are dynamics involved in it therefore the source should also be capable of responding to fast transients and dynamic changes. Therefore, the solution to this problem lies in ultra capacitor, as the name suggest it is specially designed capacitor with very high capacitance rating in order of 10 to 3000F and they can be series and parallel combined to get more higher rating. UCs has high power density and low energy density, here it can be noted that this property is visa versa of battery where energy density is high and power density is low. Also, in vehicle there will be requirement of braking and braking is the phenomena in which a large opposing force is required to reduce the driving force in very short time, so directly applying mechanical braking will reduce overall efficiency of system and wastage of energy, so to use that energy effectively we can use regeneration to restore the electrical energy back into source, but regenerative braking will deliver large amount of power in very short time period. This energy can be effectively captured by ultra capacitor and then can be used further.

Therefore by combining all the sources above we can get a unified source which has all desired quality for a drive in a vehicle. The DC DC convertor interface with all the source in such a way that o/p at DC bus remains stable in all condition of driving like starting, accelerating, uphill climbing, decelerating and stopping. The DC DC convertor for battery and UC are two quadrants and for FC it is single quadrant. The bidirectional buck boost convertor is used for UC and battery. For drive purpose I have tested on permanent magnet DC drive and PMSM drive. The PMSM drive is much promising drive to be used in EV application. Overall the thesis comprise of a unified DC source as storage, DC bus, PMSM drive comprising of inverter and PMSM with control of FOC. An energy management system which controls the vehicle in conjunction with DC sources and PMSM/PMDC drive.

ABSTRACT

The scope of this project consists of brief introduction to quadrotor system, which differs from ordinary helicopters in that it has 4 horizontal rotors and no vertical rotor. The project work consists of the study of the dynamics of a quadrotor helicopter, its stability analysis and to design and implement stabilizing and tracking control system laws using linear and non-linear control design through control of roll, pitch, thrust, and yaw.

Based on the fundamental laws of mechanics, a non-linear model of the system has been designed and simulated through various inputs. The Newton-Euler formalism was used to model the dynamic system.

The non-linear model is linearized about a hovering operating point. Both non-linear and linear dynamics are simulated in MATLAB using Simulink models. Various inputs are applied to both models so as to compare them and check the validity of the linearized model. The linearized model is then considered for controller design. A PID controller, a state feedback controller and a LQR feedback controller is implemented in MATLAB Simulink using linear dynamics. The result is then applied to the full non-linear model so as to comment upon the validity of linearized model based on the simulated results.

The application of state feedback and LQR feedback controllers resulted in the unstable quadrotor performance when implemented on full nonlinear model of the quadrotor. That motivated the non-linear controller design methods like feedback linearization; Lyapunov based controller design (like sliding mode, back stepping methods) and adaptive controller design. A control method using backstepping algorithm is proposed to design stabilizing control laws for the quadrotor.

Key words: Quadrotor, Dynamic Modeling, PID, Backstepping, UAV.

ABSTRACT

The control of Real Power Generation and Frequency is referred to as Load Frequency Control (LFC) or Automatic Generation Control (AGC) in power system. In conventional generation technology with synchronous and induction generators, natural inertial response causes a steady-state frequency deviation during primary speed control action following a change in system load/generation. Restoration of system frequency to nominal value requires supplementary control action which adjusts the load reference set point. In an isolated power system, the function of LFC is to restore the frequency to the specified nominal value. In larger interconnected power system with two or more independently controlled areas, as the supply-demand varies, the generation within each area has to be controlled so as to control the frequency and to maintain the scheduled tie-line power interchange. This is also achieved easily due to the natural inertial response of the conventional areas through Area Control Error (ACE) signal made up of tie-line flow deviation and frequency deviations.

Advancement of distributed generation (DG), substation automation, and Microgrid (MG) control software necessitated by technical and economical reasons will gradually bring about high penetration of intermittent renewable sources, associated with storage and power electronic converters, into the main power grid. Since most of the generators in the DG area are decoupled from the grid frequency by power converter, they do not contribute to the inertia of the grid and LFC of such a system requires additional control strategies than the conventional droop method.

In this thesis, Load Frequency Control of power system with high integration of distributed generation is envisaged and simulation studies on an ac MG with different methods of secondary controller tuning are done so that accurate power sharing while maintaining close regulation of the MG area frequency is achieved. Studies are done with programming in MATLAB and simulation models using Simulink.

ABSTRACT

In India, Himalayan region has the largest hydropower potential. Also, the Himalayan region is seismically the most active region. Bhakra dam is one of the largest dams existing in the central Himalayan region having potential sources of earthquake in its vicinity from where a major earthquake is predicted in the near future by seismologists. Dynamic analysis of Bhakra damreservoir- foundation system subjected to simulated scenario earthquakes from the Himalayan region has not been reported in literature.

In this study, ground motion due to scenario earthquakes of magnitude M_w = 8.5 from the Central Seismic Gap (CSG) and Kashmir Seismic Gap (KSG) regions and an M_w = 7.5 earthquake from the Kangra region at Bhakra dam site is simulated using the stochastic finite fault modelling with dynamic corner frequency approach (Motazedian and Atkinson 2005). It is observed that Kangra region earthquake owing to its proximity to the dam has the highest peak ground acceleration at Bhakra dam site.

A two dimensional finite element model of the Bhakra dam-reservoir-foundation system is analysed using software ABAQUS v 6.10 software package. Water in the reservoir is modeled with acoustic elements with pressure as degree of freedom. A finite portion of foundation is included in the finite element model. The far ends of reservoir domain is modelled to exhibit absorbing boundaries by applying boundary conditions based on absorption of normally striking body waves. To model the semi-infinite extent of foundation rock, infinite elements are placed at the ends and bottom of the foundation portion. The material behaviour is assumed to be linear elastic.

The shear force and hydrodynamic pressure developed during dynamic analysis was compared with the provisions of IS 1893:1984. It was found that the provisions of IS 1893:1984 under predicts the elastic response of structure due to implicit high ductility in the seismic coefficient. The response was also compared by considering the seismic coefficient defined as per IS 1893:2002 (part-1) with lowest ductility provision. The revised codal values were observed to be four times higher by considering seismic coefficient as per IS 1893:2002 (part-1). The maximum elastic response from finite element analysis was also found to be comparable with the increased codal values using seismic coefficient as per IS 1893:2002 (part-1).

ABSTRACT

The project illustrates frequency support from grid connected Doubly Fed Induction Generator (DFIG) in wind power applications. The DFIG is comprised of slip ring induction machine and two back-to-back converters. The stator of the slip ring Induction machine is directly connected to the grid. One converter connects the rotor of the machine to the DC-link and the second converter connects the DC-link to the grid. In this work, control of DFIG using Rotor Side Converter (RSC) and Grid Side Converter (GSC) are modelled, as well as their steady state and transient response were examined with the designed controllers. Modelling is done in dq reference frame.

Comparisons are made to between reference and actual values of various current/voltage/power/speed controllers. MPPT is done using look up table. DFIG in wind power applications is examined for grid frequency support. This was done with MPPT implementation at rated pitch angle for frequencies in between 49.5 Hz to 50.5 Hz and current control of rotor side converter is done to maintain frequency at 50 Hz. When the frequency crosses the boundary limits of 49.5 Hz – 50.5 Hz, pitch angle is varied accordingly to maintain the frequency at boundary limits. Inertial response is needed to reduce the rate of change of frequency. Simulations of inertial response from rotational mass of DFIG and also from DC-link capacitor are done.

Abstract

Fourth-order boost converter is a promising solution for applications needing low output voltage ripple and source current ripple together with stepping up of load voltage. Soft-switching (ZCT/ZVT/ZVZCT) can be typically implemented in FOBC. The objective of this thesis is to propose, analyze, design, implement, and experimentally validate the operation of modified zero-current transition switching for the above mentioned fourth-order boost converter that does not have any of the drawbacks that other converters of this type have, such as: (i) complicated auxiliary circuit, (ii) increased current stresses in the main power switches. In this thesis, the general operating principles of the ZCT FOBC are reviewed, and the converter's operation is discussed in detail and analyzed mathematically. As a result of the mathematical analysis, the voltage/current equations that describe the operation of the auxiliary circuit and other converter devices have been derived.

Steady-state analysis and mathematical modeling of the modified zero-current transition fourth-order boost converter is done and the auxiliary circuit elements are designed for the specifications of the converter. In order to analyze the dynamic performance of the designed converter, the control -to-output voltage discrete-time transfer function is obtained through system identification approach. The digital voltage-mode controller is designed in MATLAB in order to achieve load voltage regulation against various perturbations in load, source and parameters. The details of soft-switching of the modified zero-current transition fourth-order boost converter are illustrated along with simulated and identical experimental results. The principle of operation and performance of the converter are explained.

Then, because of the structural advantage of the soft-switching cell under consideration, plus fourth-order boost converter together, it is examined for the chances of achieving zero-voltage transition (ZVT), zero-voltage zero-current transition (ZVZCT), and found it possible by properly adjusting the gating sequence to the auxiliary switch in co-ordination with the main switch. The above investigation has been done without changing the converter parameters. Proper digital controllers have been designed for ZVT, and ZVZCT of operations also, and the converters dynamic performance against various source/load disturbances is investigated. The variation of soft-switching load region with respect to the type of operation has been evaluated mathematically and validated its correlation with the experimental results.

ABSTRACT

Load Commutated Inverter fed Synchronous Motor Drives are the natural choice for high power applications for the loads which demand variable speed and torque requirements. Such drives have been finding increasing applications in generating stations for equipments such as fans and compressors. Controllable power factor and higher full load efficiencies compared to the induction motors of corresponding rating put LCI drives at advantage in terms of the savings on the operation and maintenance. These drives are available in the basic six pulse and twelve pulse configurations. In the latter, two winding motor is used considering the criticality and operational requirements.

This project work aims at creating model of an LCI fed synchronous motor drive from basic configurations of synchronous machine and converters and analyzing the same under various dynamic operating conditions. To update with present trend of improving the power quality one of the best model is simulated as well as hardware implementation was done up to some extent. NTPC has adapted the LCI fed synchronous motor drives for the Induced Draft (ID) fans in many of the generating stations. In this context, the present project shall prove to be relevant to the needs of both the design and the maintenance engineers.

Simulation of both six pulse and twelve pulse operation of the LCI fed synchronous motor drive has been successfully done for starting as well as low speed operation. In dual channel drive, the modeling was done for both six phase machine as well as rotor coupled machine. Starting as well as load variations and speed variations have been studied.

Also a diode rectifier-chopper based LCI drive has been modeled for both drives i.e. larger capacity one which is used in NTPC stations as well as for machine available in the lab. As a part of hardware the above configuration has been implemented with the help of DSP controller TMS320F2812.

ABSTRACT

Construction is the second largest industry in the India, being next to agriculture. Most of the construction works are executed through contracts. Due to unique feature of construction activities, ambiguity involved in contract conditions/clauses, varied objective of owners and contractors, many a time dispute arises. The performance of Indian construction projects in India has not been encouraging and most projects have considerable time and cost over runs, have strong two way link with disputes.

There are various traditional forms of construction contracts prevalent in the Indian construction industry. Some of mostly used contract forms are CPWD, MES, Bureau of Public Enterprises (BPE) forms of contract and Railway etc. These departments use contract forms similar to one or the others standard forms with some differences in contract clauses and conditions and hence contractors face problems whenever they switched over from one department to other. Very few studies have been done to better understand the difference between the contract condition/clauses in different forms of contract. However, if a standard contract form, applicable to all departments is brought in to use most disputes arising out from differences in contract condition and clauses could be avoided.

Taking lead from this, a study of contracts of two Central Governments form are undertaken, CPWD and National Thermal Power Corporation (BPE form of contract) dealing with the construction works in the Country. This study helps the professionals for developing a unified and standard contract document to reduce propensity of disputes.

The main aim of this study is to assess the difference in the two contract forms and to evaluate how the difference in various contract clauses has affected the occurrence and resolution of disputes. For this, Arbitration cases of NTPC and CPWD contract form have been selected and analyzed to suggest improvement guidelines in contracts and Identification of area of improvement in defining contract clauses to reduce propensity of disputes. The major clause wise differences between NTPC and CPWD forms of contract and certain dispute prone contract clauses are also listed out from the study. The study limits to the projects carried out in the Indian scenario only.

Key words: *Construction contracts, contract disputes, contract clauses, CPWD clauses, NTPC clauses, Arbitration awards, Propensity of disputes*

Abstract

Solar thermal energy can be involved in different ways in existing power generation plants in order to replace the heat produced by fossil fuels. Solar aided feed water heating (SAFWH) appears to be a prospective option for using solar thermal energy in existing or new coal-fired thermal power plants. Bled-off steam from turbine which is used for feed water heating in a conventional power plant can be replaced by solar energy. In a 500 Mw power plant additional power generation that could be obtained is around 17.41 % by replacing bled-off steam of all closed feed water heaters with solar energy without any additional fossil fuel input to the boiler. In this study an attempt made to calculate the additional power generation that could be achieved under power boosting mode, fuel savings under fuel saving mode, percentage of efficiency improvement, reduction in specific fuel consumption, solar to power efficiency and percentage of solar for various capacity of power plants like 195 MW, 500 MW, 660 MW and 800 MEGAWATT power plants and comparison has been made. In addition the performance comparison of flat plate collectors and evacuated tube collectors for replacing bled-off steam of low pressure (LP) feed water heaters and performance comparison of parabolic trough collectors and linear Fresnel reflectors for replacing bled-off steam of high pressure (HP) feed water heaters is also carried out. The payback period could be 4 years for SAFWH of LP feed water heaters and 7 years for SAFWH of HP feed water heating in power boosting mode. Levelised cost of electricity (LCOE) is also found around Rs 2.28 in case of SAFWH of LP feed water heaters and around Rs 3.6 in case of SAFWH of HP feed water heaters per kWh.