Department of Electrical and Electronics Engineering
National Institute of Technology Tiruchirappalli

EEE NEWSLETTER

http://www.nitt.edu/home/academics/departments/eee/ Vol 1 , Issue 2 , July 2012

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EDITORIAL

The department of Electrical and Electronics Engineering has always been striving for excellence in the teaching-learning process, research and in all other activities focussed towards creating a strong foundation over which our students can build a successful professional career. During the farewell party, the students of the batch 2008 – 2012 mentioned that though EEE was not their first choice of discipline in Engineering, they were immensely satisfied as the course progressed and they got moulded to being highly competent engineers.

I am very happy to record that we have achieved almost 100% placements, with a large number of students placed in reputed core companies and public sector units. A good number of students have also opted for higher studies and in this context, I am glad to mention that one of our students secured an All India Rank of eight in GATE – 2012.

Our students have participated in technical competitions conducted by other organizations such as the prestigious TI analog design contest and brought laurels to the department. The EEE association had successfully conducted CURRENTS 2012 (a national level technical symposium) in the month of March with large number of technical competitions and impressive events. Apart from the academic arena, our students have also evinced interest in a number of extra curricular activities and performed well in the inter-departmental cultural festival - NITTFEST.

In the last few months, our faculty members have organised a series of short-term courses in the emerging areas pertaining to the field of Electrical and Electronics Engineering. These courses witnessed an overwhelming response from teachers of other engineering colleges, who gave a very encouraging feedback.

(N. Kumaresan)
Head of the Department, EEE

EDITORIAL BOARD

SHORT COURSES

SUPPORT VECTOR MACHINES

A course on "Support Vector Machines" was held by the Electrical & Electronics Department on 8th June, 2012. The event was carried forward by experienced hands in the field, Dr.Mirnalinee from SSN College of Engineering, Chennai, Dr.Punniyamurthy, Department of Management Studies and Dr.D.Deivamoney Selvam, Department of Mathematics, NIT Trichy. More than 60 students benefitted from this course on topics such as Determinant Analysis, Introduction to SVM and Pattern Recognition using SVM conducted by Dr.S.Sudha (EEE Department), Dr.C.Mala (Computer Science Department) and Dr.N.P.Gopalan(MCA)

PIC MICROCONTROLLER APPLICATIONS IN POWER ELECTRONIC CIRCUITS

A short term course on "PIC Microcontroller Applications in Power Electronic Circuits" was organized by the Department of EEE on 22nd and 23rd June 2012. The course dealt with interfacing of PIC microcontrollers with Power Electronic Converters. The speakers, Dr.N.Ammasai Gounden and Dr.N.Kumaresan, did an exceptionally great job in practically demonstrating the usage of PIC microcontrollers in the lab. Features of PIC and simulation were discussed and the students were also given a quick introduction to MPLAB.

Dr.N.Ammasai Gounden and Dr.N.Kumaresan during the lecture on PIC Microcontroller Applications

LATEX COURSE

A two-day course on Latex was conducted by Dr.S.Sudha (EEE Department), Dr.C.Mala (Computer Science Department) and Dr.N.P.Gopalan(MCA), NIT Trichy between the 5th and 6th of July 2012. Retired Prof. Kaliappan from St.Joseph's College, Trichy, guided more than 70 enthusiastic students on various topics pertaining to coding and preparation of research papers during the course.

RESEARCH METHODOLOGIES

The Indian Institute of Technology, Bombay conducted an in-depth course on "Research Methodologies" across a period of ten days. This event was co-ordinated by the faculty members: Dr.S.Sudha (EEE Department), Dr.C.Mala (Computer Science Department) and Dr.N.P.Gopalan(MCA) of our institution. Speakers from IIT-B guided the participants via video conferencing . The course was held between 25th June and 4th July, 2012. The course, which was aimed at enlightening participants on writing and reading research papers, reviewing and presenting them, was made use of by 50 research scholars and faculty in and around NIT Trichy.

Participants during a short term course

POWER SYSTEM STABILITY ISSUES WITH DISTRIBUTED GENERATORS

A two day course on "Power System Stability Issues with Distributed Generators" was organized and conducted by Dr.M.P.Selvan. The course saw about 30 participants including students and faculty from various self-financing colleges, universities and members from government organizations such as TNEB. Day 1 was handled by Dr.M.P.Selvan and the lab session was assisted by the research scholars of the department. Day 2 was handled by Dr.K.Vinoth Kumar, an expert from ABB Global Services and Industries Ltd. The course highlighted the importance of power system operation and control to maintain synchronism in the grid and the various issues associated with the same.

Short term course on Power System Stability Issues with Distributed Generators

EFFECTIVE WRITING OF TECHNICAL PAPERS

The two day program was conducted to introduce the participants to technical paper writing skills and educate them about the same using Latex and slide preparation using Beamer.The first day of the program dealt with technical paper writing skills while the next day was dedicated for Latex and Beamer.

The course was conducted on the 7th and 8th of July, 2012 by Dr.G.Saravana Ilango and Dr.V.Sankaranarayanan. There also were practical session on installing the software and typesetting in known formats for IEEE conferences and journals.

Dr.V.Sankaranarayanan during the course on Effective Writing of Technical papers

POWER SYSTEM PROTECTION ISSUES WITH DISTRIBUTED GENERATORS

A two day short term course on "Power System Protection Issues with Distributed Generators" was organized and conducted by Mr.P.Raja. 75 participants including students and faculty from various self-financing colleges and universities participated in the course. Day 1 was handled by Mr.P.Raja on the fundamentals of Power System Protection. Day 2 witnessed Dr.M.P.Selvan and Ms.M.Venkata Kirthiga, Dept. of EEE, NIT Trichy handling the topics on Distributed Generators and Optimization Techniques respectively. The day was concluded with Mr.Ismail, an Engineering Trainee from BHEL, Trichy handling a lab session on PSCAD. The course highlighted the importance of power system protection issues when DG is incorporated in the system and also discussed some of its solution techniques.

During a lecture of the short term course on Power System Protection Issues with Distributed Generators

MODELING OF ELECTRICAL SYSTEMS USING MATLAB/SIMULINK

The aim of the course was to impart knowledge and skills for modeling and simulation of electrical systems. The course was handled by Dr.G.Saravana Ilango and Mr.S.Senthil Kumar. There were 50 participants from various colleges and industries. The course was conducted over 2 days, with an introduction to MATLAB/Simulink and modeling of simple circuits on the first day by Dr.G.Saravana Ilango, and modeling of various electrical machines on the second day by Mr.S.Senthil Kumar. The feedback of the course was good and an advanced course in the same was suggested.

Dr.Saravana Ilango delivering a lecture during the course

APPLICATION OF BIOLOGICALLY INSPIRED ALGORITHMS FOR POWER SYSTEM AND POWER ELECTRONICS ENGINEERING

The one day course was conducted on the 28th of July 2012, with an aim of explaining the fundamental concepts for the implementation of genetic algorithms and ant colony optimization techniques for power electronic converter design and electrical power dispatch applications. The use of these techniques in MATLAB was also explained. The course was conducted by Dr.K.Sundareswaran, Dr. Sishaj.P. Simon and Mr.P.Srinivasarao Nayak. A total of 158 individuals from various industries and engineering colleges participated in this short term course.

SHORT TERM COURSE ON FPGA BASED SYSTEM DESIGN

A short term course on FPGA Based System Design was organized by Dr.S.Moorthi on 13th and 14th of July, 2012. The course saw varied participation with undergraduate students, post graduate students and faculty from various colleges. Day 1 took off with Dr.S.Moorthi educating the participants about digital IC design, importance of FPGAs and giving them a gist about the hardware description languages namely Verilog HDL and VHDL. The rest of the day was handled by the student volunteers who demonstrated their projects and conducted lab exercises and tutorials. The second day saw an expert from the industry, Mr. Venkatesha.K from Entuple Technologies, Bangalore who covered Embedded Systems in-depth in the forenoon session and thereafter guided the participants with the lab session in the afternoon session. The course was concluded with a note by our HOD for the participants and certificate distribution.

Short term course on FPGA based System Design

INDUSTRY INTERACTION

ENTUPLE Technologies, Bangalore

Our department witnessed the visit of an expert from the Embedded System design industry,Mr.Venkatesha from Entuple Technologies, Bangalore on 14th July, 2012. He visited as a part of the short term course on FPGA Based System Design.

Mr. Venkatesha described the importance of programmable logic devices, field programmable gate arrays etc. He clearly highlighted the differences between FPGAs, microcontrollers and embedded systems. He also gave an in-depth insight of how to develop an embedded system using FPGAs and also briefed about the various tools available in the market for the design of the same. Since the design of embedded systems using FPGAs is new and evolving at a rapid rate, the participants were all the more enthusiastic and bombarded him with a lot of questions which made the session extremely interactive.The latter half of the day was followed by hands-on tutorials lead by Mr. Venkatesha and all the participants actively followed up on the tutorials which involved LED and touchscreen interface etc. His interaction with the students of the department and the participants of the course proved to be extremely useful. Entuple Technologies have always been pillars of technical support and have promised to continue their support in future too.

Mr. Venkatesha at the presentation

Interaction in the Simulation Lab

ABB Global Services and Industries Ltd.

Dr.K.Vinoth Kumar, an associate scientist in the Grid Systems R & D department, ABB Global Services and Industries Ltd., visited our department as a part of the industry interaction representing ABB, Chennai. He completed his Ph.D on "Investigations on Distributed Generation Planning and Certain Grid Interaction Issues of Wind Turbine Generator System" from our institution in the year 2011. He has 20 publications in national and international conferences and journals to his credit.

His research in the industry pertains to "Wind Power Interconnection to VSC HVDC Transmission Systems". Dr.Vinoth shared his expertise on "Concern on Voltage Stability Issues for DG Generation" during the short term course on Power System Stability Issues with Distributed Generators on the 30th of June, 2012.

Dr.K.Vinoth Kumar

ALUMNI INTERACTIONS

KARTHIK KANNAN NATARAJAN

Karthik Natarajan Kannan is an Associate Professor at Purdue University's Krannert School of Management. Dr.Kannan received his Ph.D. in Information Systems from Heinz School at Carnegie Mellon University. He received a Bachelor's degree in Electrical and Electronics Engineering from National Institute of Technology Tiruchirappalli in 1996. He also has two Master's degrees in Electrical and Computer Engineering and Public Policy Management from Carnegie Mellon University.

His two primary areas of research are: Auctions in Electronic Contexts and Economics of Information Security. His work along with Professors Jackie Rees and Eugene Spafford on the Unsecure Economies Report received considerable attention, including the White House Cyberspace Policy Review. He has also been quoted in the Forbes Magazine on the related topic.

Karthik, one of our distinguished alumnus, visited the department in the month of July, 2012 and interacted with the senior faculty.

ARAVIND NATARAJAN

A presentation and a demonstration on "Object Tracking using Video Processing on FPGAs" was delivered by our immediate pass-out Mr.Aravind Natarajan, as a part of the short term course on FPGAs and Embedded Systems. Aravind Natarajan is currently pursuing his masters on "Digital VLSI and Embedded Systems" at Texas A&M University, Texas.

SIDDHARTH KULASEKARAN

Siddharth Kulasekaran, a pass-out of 2010 batch, who is currently pursuing his Doctorate of Philosophy on "Power Electronic Drives using DSP's" at Arizona State University, visited our department again on the 28th of July, 2012 to spend quality time with all the faculty and also to share his experiences about his post graduate studies in the United States. He also updated us about the latest research being carried on at his university. As a good-will gesture, Siddharth presented a DSP kit manufactured by Texas Instruments to the VLSI Systems Research Lab of our department.

CONFERENCE AND JOURNAL PUBLICATIONS BY OUR FACULTY AND STUDENTS

INTERNATIONAL CONFERENCES

1. M.Rajasekaran, M.Venkatakirthiga, "A Modern Self Defined Extinction Advance Angle Controller for CCC based Hybrid HVDC Systems", 3rd International Conference on Computing and Control Engineering, 12-13 April 2012, Chennai.

2. Ranjith Kumar.S, Surendhar.S, P.Raja, "Assessment and Comparison of Different Neutral Current Compensation Techniques in 3-phase 4-wire Distribution Systems" 3rd IEEE Conference on Power Electronics for Distributed Generators Systems, 25-29 June 2012, Denmark.

3. B.Indu Rani, G.Saravana Ilango, C.Nagamani, "A Three-Phase Reference Current Generator for Power Electronic Converters under Distorted Utility Conditions ", International Conference on Computing Electronics and Electrical Technology (ICCEET), 21-22 March 2012.

INTERNATIONAL JOURNALS

1. K.Vijayakumar, N.Kumaresan, K.Amara Bhagavan and N.Ammasai Gounden, "A DSP based Closed Loop Controller for Power Smoothing Operating of Wind-Driven WRIG Systems", International Review on Modelling and Simulations, Vol. 5, No. 1, 2012, pp. 185-192.

2. M.Venkata Kirthiga, S.Arul Daniel, S.Gurunathan, "A Methodology for Transforming an Existing Distribution Network into a Sustainable Autonomous Micro Grid", IEEE Transactions on Sustainable Energy, accepted for publication in 2012.

3. B.Indu Rani, G.Saravana Ilango, C.Nagamani, "Control Strategy for Power Flow Management in a PV System applying DC loads ", IEEE Transactions on Industrial Electronics, accepted for publication in 2012.

4. B.Indu Rani, C.K.Aravind, G.Saravana Ilango, C. Nagamani, "A Three-Phase PLL with a Dynamic Feed Forward Frequency Estimator for Synchronization of Grid Connected Converters under Wide Frequency Variations ", International Journal on Electrical Power and Energy Systems, Vol.41, Oct 2012, pp 63-70.

SEMINAR PRESENTATION BY OUR PH.D SCHOLARS

Sl. No.	Title	Name of the scholar	Name of the Guide(s)
1.	Investigation of Control Techniques for Effective Utilization of Solar PV systems	Ms. Indu Rani	Dr.G.Saravana Ilango
2.	Performance Evaluation of FACTS Devices in Generation Scheduling	Mr. S. Sreejith	Dr.Sishaj P.Simon & Dr.M.P.Selvan
3.	Analysis and Control of Grid-Connected Wind-Driven Wound Rotor Induction Generators	Mr. K. Vijayakumar	Dr.N.Kumaresan

Projects by Students And Faculty of EEE

MITACS Globalink Fellowship – University of Manitoba, Winnipeg - Summer 2012

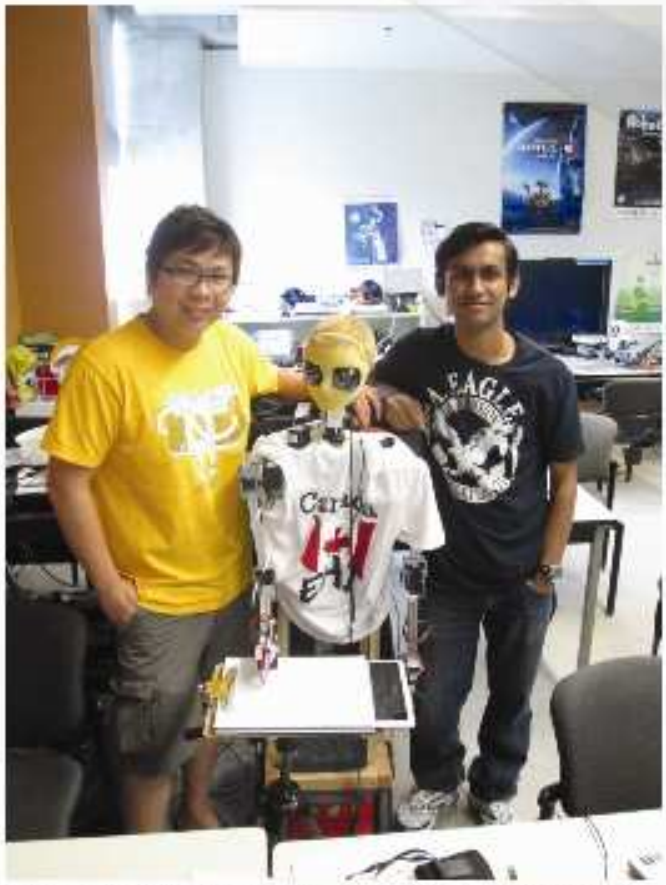
My experience this summer was one of the best I've ever had. I was one of the few favorable students who received the MITACS Globalink scholarship this year to pursue research as an intern at the University of Manitoba. During my internship, I worked on "Torque Based Feedback Model for Humanoid Robots".

As a part of the scholarship, my travel, visa and residential expenses were taken care of apart from a weekly stipend of 200$. On my arrival, after my first international flight (28 hours long), I was received by the Globalink student advisor and taken to my place of stay. I was given a tour of the university and the various laboratories, out of which the name Autonomous Agents Laboratory, impressed me the most. The first day at the Autonomous Agents Laboratory was spent in exchanging pleasantries with my professor. For the first two weeks I was made to study the concepts relating to humanoid robotics and computer programming relating to the same. Of the weeks ahead, I was made to work upon a humanoid robot named 'Betty'. The goal of the project was to improve the drawing capabilities of Betty via a feedback model. The feedback was based on the pressure that the robot put on the drawing pad, a graphics tablet and the torque applied by the servo to draw a particular stroke. The robot used a controller to control the servos that handled the drawing capabilities. My objective was to program the controller so that appropriate drawing stroke was implemented and to develop a Graphics User Interface so that commands could be sent to Betty using the computer.

The weekends were spent enjoying Canada. I attended a baseball game, a football game and went kayaking with my student advisor. Mini-golfing, motor boating, visiting the art gallery were some of the activities which we cherished during the weekends.

The relationship I had with my advisor was an informal one. I was also made to feel extremely comfortable so that I could perform better. Canadian people are known for their humble and friendly behavior and you feel at ease in such an environment.

MITACS aims at attracting Indian students to pursue higher education in Canada. Most of the Indian students pursue their graduate studies in the United States and MITCAS wishes to change that. From my experience I would definitely say that Canada would be a good option for higher education.



Himanshu with his mentor at University of Manitoba, Canada

Himanshu Mehra
B.Tech - Final Year
EEE

Non-Linear Discrete Time Observer and Controller Design for a Chaotic System

A world without control leads to instability, pushing the poles of life form to an unstable region in the complex plane of existence.

The Chaos theory details the rich behavior of dynamical systems. These systems have a strong sensitivity to initial conditions, yielding diverse results if such variations in the starting conditions are observed. Taking a simple dynamic system such as a pendulum, the system is governed by an ordinary differential equation with a small non-linearity from the restoring torque term. We generally linearize it assuming the angular variation is very small and proceed further with the study. For a linear analysis, the same procedure is carried out by linearizing the system around their respective operating points to study the system's behavior. The nonlinearity of the system generally increases with the system's complexity.

The main idea of my project is to stabilize and control a system in a best possible way at their respective stable states from the observer's design. A controller is a device which monitors and modifies the operating conditions of the system while an observer is a system that models a real system by estimating the internal states, provided with some measurements. The system assigned to me during my research intern was a double pendulum-cart system and a three linked robotic arm (as shown in the figure with the third link being a baseball bat). Here, the above first system is explained.

The double pendulum-cart system is a higher order complex system, with either of the link ends attached by a bearing. Although equally mathematically predictable, the system exhibits extraordinary complex behavior with their patterns deviating from the mathematically predicted one. The motion of the double pendulum is governed by a set of coupled sixth order nonlinear differential equations and the system exhibits chaotic behavior for certain energies.

The main objective of this method is to control the multi-linked systems in their respective equilibrium states by constructing a suitable non-linear observer based controller. The system is to be represented by non-linear difference equations for the discrete time analysis and these equations are solved for gaining the knowledge of the equilibrium states. For this system, there are four equilibrium states involving six different internal states.

The nonlinear controller can be viewed in two parts, a stabilizing controller and a swing up controller. The stabilizing controller stabilizes the system around the equilibrium points by linear state analysis while the swing up controller is used to swing the system to approach the required operating point. The swing up controller is designed by a reverse dynamic shaping algorithm for swinging up the system subjected to several constraints such as time, acceleration requirements, etc. This algorithm requires the knowledge of the nonlinear observer.

The nonlinear observer design is built using either of the two techniques; the Nonlinear Complex Space Optimization (NECSPO) and the Extended Kalman Filter (EKF) approach. The two techniques were used in my project for building the observer with accuracy close to 100%. The final algorithm is loaded into RTOS to interface with the physical system.

The observer based controller is finally used for controlling the system dynamics. The robot arm is a continuation of this project with higher degrees of freedom and inclusion of another space dimension. Meanwhile during my project, I also got to work on a Hexapod Robot which can crawl on rough terrains and climb on walls. I gained a rich experience during my internship and worked with a lot of practical control systems.

Srinivas Kandasamy
B.Tech - Final year
EEE

DAAD WISE SCHOLARSHIP - TECHNISCHE UNIVERSITÄT MÜNCHEN , SUMMER 2012

Being selected as one of the WISE (Working Internship in Science and Engineering) scholars under the DAAD (Deutscher Akademischer Austausch Dienst) student exchange program for the year 2012, I had an enriching experience working in the fourth best University in Europe- Technische Universität München.

I was accepted by Prof. (Dr.) Ralph Kennel, heading the Department of Electrical Power Systems and Power Electronics, as an intern and was supervised by Felix Rojas L., M.Sc., a PhD Candidate under Dr. Kennel. My two and a half month project focused on "Predictive Current, Speed and Rotor Angle Position Control of a Permanent Magnet Synchronous Motor".

Permanent Magnet Synchronous Motors (PMSM) are normally driven by Voltage Source Inverters (VSI). Such systems are usually controlled by Field Oriented Control or Direct Torque Control. My role was to develop a new control technique called Model Predictive Control (MPC) which makes use of the discrete nature of the output voltage of a VSI. The MPC technique is conceptually simple and is based on the prediction of the effects of all possible actuation values on the variables to be controlled, and the subsequent choice of the best actuation value, as measured by an appropriate cost function. One of the main advantages of this control technique is that many parameters, both electrical and mechanical can be included in a single cost function and therefore it becomes an integrated multivariable control.

The overall experience was breathtaking for me as apart from the technical knowledge I gained, the entire two and a half months packed with loads of fun. From being sun baked in Italy to tasting the authentic Belgian Chocolates and skiing in the Swiss Alps, I cherished every moment and lived it to the fullest.

Varsha Padhee
B.Tech - Final Year
EEE

DAAD WISE SCHOLARSHIP TECHNICHE UNIVERSITAT BERLIN , SUMMER 2012

Summer of 2012 has been one of the most memorable summers of my life so far. As a DAAD WISE scholar, I interned at Techniche Universitat Berlin under Prof. Dr. Roland Thewes.

A circuit was being built for DNA injection into a single cell through chromoporosis and I contributed by simulating the main circuit in LtSpice, designing a PCB for testing the output of the chip, known as the ImaChip and created a computer interface for the same using National Instruments' LabVIEW.

This internship provided me a platform to showcase my talent and enhance my technical skills. What impressed me the most about the Germans was their work culture, passion and dedication towards research. It all stems out from the freedom they have in choosing their own stream. My group was a mixed bag and had people from different cultures. All of them were very friendly and helpful. Being a vegetarian, I always wondered if I would be able to manage food. To my surprise I never faced a hitch. Berlin being a multi-cultured city had many Indian supermarkets and restaurants. The weather there was very pleasant and it was fun touring around Berlin with my fellow NITTians.

Harini . M
B.Tech - Final Year
EEE

AUTONOMOUS ELECTRIC VEHICLE

An autonomous electric vehicle is being developed in the Control System Research Laboratory (CSRL) headed by Dr. V. Sankaranarayanan, Associate Professor of EEE department together with his research scholars Mr. Joseph Godfrey and Mr. Anchal Viswamitra. The main aim of this research project is to design and fabricate an autonomous electric vehicle with the intention to study various autonomous operations such as lane keeping, dynamic stability, power assist steering and regenerative braking. This vehicle is equipped with two Brushless DC Motors (BLDC) on the rear wheels and these motors are controlled through inbuilt state-of-art controllers. This 100 Kg - two seater is powered by four 12V - 20 Ah Exide batteries. A battery charger is designed such that all three stages of charging topology named constant current, constant voltage and floating mode are followed through a closed loop control strategy. This charging circuit is housed in the laboratory and connected though a dedicated computer to monitor various parameters on line while charging which further helps in the analysis of State-of-Charge (SOC).

The dynamic stability of the vehicle is studied through a dedicated Inertial Measuring Unit (IMU) which is fixed in the center of the vehicle. This IMU senses accelerations in x, y and z directions and angular velocity about any two axis. These five signals are used to estimate various stability performance such as lateral motions, skidding and rolling motions. These performance measures are used to design closed loop control algorithms to maintain the stability through controlling individual BLDC motors fitted on the rear wheels.

The current position of the vehicle is estimated thorough dead reckoning and Kalman filter algorithms. Two proximity sensors are fixed on the rear wheels to measure the speed of the wheels to execute the dead reckoning algorithm and the outputs from IMU unit are used to execute the Kalman filter algorithms. Both these methods can predict the current position accurately without the help of Global Position System (GPS). The position of the vehicle is used for autonomous operation such as lane keeping or taking of the given trajectory.

The regenerative braking is implemented to conserve the kinetic energy stored in the vehicle while braking. A DC-DC converter (Boost converter) is connected in between the BLDC motor and the battery to pump the energy back to the battery while braking. It is also planned to study various switching topology on the BLDC motor to realize the regenerative braking with out the help of any DC-DC converters.

For further details please visit www.nitt.edu/csrl

Dr.V.Sankaranarayan
Associate Professor, EEE
NIT Trichy

PORTABLE SOLAR POWERED MOBILE PHONE CHARGER

The project aims at charging cell phones batteries using solar energy. To harvest solar energy, a concave hemispherical solar panel is used, which has increased efficiency. The output of the solar panel is sent to a buck-boost converter which is controlled by a microcontroller which charges the cell phone battery. In the absence of sunlight, a separate internal battery arrangement is provided to charge the battery. The internal battery is charged when the cell phone battery is not connected. The transition between the use of the internal battery and the buck-boost converter to charge the battery is controlled by a relay which is controlled by the microcontroller. The target is set to building a feasible working model of a portable solar powered mobile phone charger with a higher efficiency compared to existing systems.

Divya S (3rd year, EEE)
Mandakini PV (3rd year, EEE)
Rathna R (3rd year, EEE)
Padmapriya Duraisamy (3rd year, ECE)

SOLAR BASED HYBRID ELECTRIC POWERED WHEEL CHAIR

Wheel chairs provide independence in life style differently-abled people. Man modified wheel chairs into electric powered wheel chairs to help them travel greater distances. Typical electric wheel chairs suffer a serious drawback due to the continuous drain of charge of the storage batteries. By charging the batteries on the run, this setback is eliminated. Solar power is an inherently sustainable and green energy. In this system the batteries are charged by photo voltaic panels through a DC-DC converter using MPPT algorithms. To ensure flexibility AC-DC converter is incorporated into the system so as to allow charging via conventional means. The System is also designed to monitor the charge and prevent overcharging of the batteries. An analog joystick is used for navigation.

Kishore P (3rd year, EEE)
Manikandan Ananth (3rd year, EEE)
Vivekanandan B (3rd year, EEE)
Sethu Chidambaram (3rd year, EEE)

SOLAR POWER BASED INTELLIGENT BATTERY CHARGING SYSTEM COMPATIBLE WITH EXISTING HOME INVERTERS

In recent times due to power shortage in cities, it has been a basic necessity to install an inverter in every home. Though the main idea of power cut in cities is to reduce power usage, using an inverter destroys this purpose, as the power delivered by the inverter during power cut is actually consumed by the inverter at the times when the grid is supplied with power. Thus, we propose to charge the inverter battery using clean energy to solve the problem in the existing system.Each PV panel used is coupled with a DC-DC (buck) converter and supplies power to the common DC bus bar which is connected across the battery via a battery monitoring system (BMS). This is connected to a home inverter (single phase). There is also an additional control for the intelligent switching of the supply from the grid. If the battery is partially charged, the PV panels, which operate at MPPT charge the battery provided there is sufficient insolation (solar radiation energy on a given area at for a given time period). In case of low insolation, the supply from the grid charges the battery. The power supply from the grid drives the load at home. If the battery is fully charged, the grid is disconnected from the load and the battery supplies the load. The battery is also simultaneously charged by the PV panels. This continues until the battery charge falls below a particular reference and then the supply is connected back to load. One important case is the no-load condition in the house. If the battery is fully charged and the PV panels charge the battery at the same time, the excess charge may damage the battery. So the PV panels are made to operate at a constant voltage level equal to the voltage level of the battery to prevent excess charge flow to the battery.

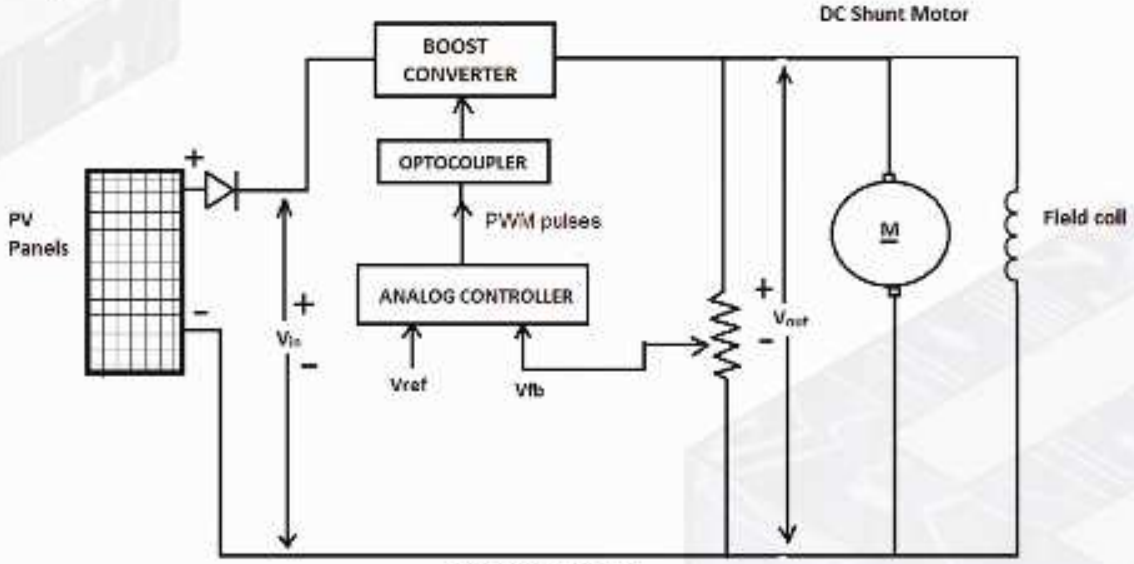
Pankaj Raghav P (3rd year, EEE)
Ramesh K Govindarajan (3rd year, EEE)
Dinesh P (3rd year, EEE)
Kowshick B (3rd year, EEE)

Low Cost DC-DC Controller for Electricity Powered Vehicles

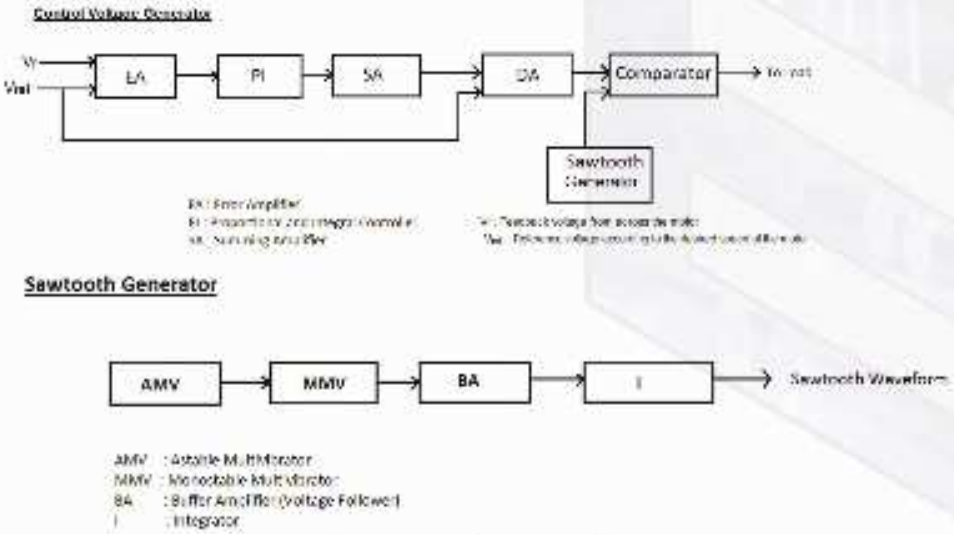
Harini M. (EEE), R. V. Layamrudhaa (CSE), S. Harini (ICE) and Varsha Padhee (EEE) participated in the Analog Design Contest, hosted by Texas Instruments. The team, supervised by Prof. (Dr.) N. Ammasai Gounden, developed a "Low Cost DC-DC Controller for Electricity Powered Vehicles".

The uniqueness of this project lies in the fact that the controller designed was purely analog and the entire setup was solar powered. The main objective was to achieve proper speed control of a DC shunt motor.

Utilization of solar energy for supplying an isolated load, motor load or utility grid has been experimented previously. Such existing schemes have employed a digital controller for interfacing the power electronic circuits with the load. The digital controller used in the above mentioned schemes, was replaced by a purely analog circuit. The problems encountered in the usage of a purely analog controller (without using microprocessors or microcontrollers) were averted by making appropriate changes to the design. The project targets the fossil fuel driven vehicles, especially the lower cubic capacity two wheelers. Since the controller employed is simple, and easy to implement, the maintenance of such electric vehicles is simple without the need for skill and technical expertise. It addresses the technical challenge of maintaining the duty ratio to see that the motor does not go out of control under any situation and is cost effective.



Circuit diagram



Block diagram of the controller

The goal of the project was to control the speed of a DC shunt motor powered by the boosted output voltage from the PV panels. They designed and fabricated an analog controller for automatically varying the duty ratio of a DC-DC converter for obtaining any required magnitude of DC voltage from a variable low level DC supply, i.e. the output of PV panels. The required DC voltage thus obtained was used for controlling the speed of a DC motor.

The assumed input was a variable voltage supply of 60-80 V from the PV panels. The required speed of the motor was given as reference input (V_{ref}) to the controller. The expected output was the required DC voltage corresponding to the reference speed. The speed can be set manually by changing the value of V_{ref} fed to the controller using a potentiometer.

They were shortlisted as one of the 15 finalists from all over India and won a consolation prize. The project was demonstrated at the Texas Instruments campus in Bangalore on the 6th of April, 2012 and garnered a lot of appreciation from the judges.

The team worked at the NaMPET (National Mission for Power Electronics Technology) Laboratory at the EEE Department and was ably assisted by Mr. D R Binu Ben Jose, who is currently pursuing his Ph.D under the guidance of Dr. N Ammasai Gounden.

A video of the project demo can be viewed at: http://goo.gl/OiCrW

From left C. P. Ravikumar, Dr. N. Ammasai Gounden , Layamrutha ,TI Director ,Harini and Varsha

During the question answer session with Dr.K.R.K.Rao

Varsha Padhee (EEE)
Harini M (EEE)
R. V. Layamrudhaa (CSE)
S. Harini (ICE)

"Don't use 'i', it's for current"...

Importance of Mathematics in Electrical Engineering

Food for thought! Two contrasting takes on mathematics...

> Why are numbers beautiful? It's like asking why is Beethoven's Ninth Symphony beautiful. If you don't see why, someone can't tell you. I know numbers are beautiful. If they aren't beautiful, nothing is.
>
> - Paul Erdös

> *There was a young man from Trinity,*
> *Who solved the square root of infinity.*
> *While counting the digits,*
> *He was seized by the fidgets,*
> *Dropped science, and took up divinity.*

Mathematics, often dubbed as the Queen of sciences is an infinite world by itself and is the impetus driving all sciences. Its vastitude is evident from Aristotle's definition of continuum (the set of real numbers) – "The continuum is that which is divisible into indivisibles that are infinitely divisible".
Speaking about engineering, it enjoys the monopoly of being the practical face of science. Here's a witty byword stressing this fact.

> To the optimist, the glass is half full.
>
> To the pessimist, the glass is half empty.
>
> To the engineer, the glass is twice as big as it needs to be...

Electrical engineering deals with the manipulation of electrons and photons to produce products that benefit humanity. The design of these products is based on scientific principles and theories that are best described mathematically. Mathematics is thus the universal language of electrical engineering science.
Beginning with basic systems, circuit theory at its simplest form is really differential equations, which is basically solving equations involving derivatives, so calculus, algebra and trigonometry are fundamental to understanding it. Every basic circuit element (resistor, capacitor, and inductor) has a related current-voltage relation determined by its impedance. This is where complex numbers come in. So even in the first area of EE, circuit theory, there's already calculus, complex numbers and the Laplace transform.
If we move on to the theory of "how" electromagnetism works, we have Maxwell's equations. They are written in both integral and derivative forms and involve vectors. So, suddenly, we also have vector calculus.
Moving on to networks, it involves nodes communicating with each other. A lot of computers linked together form a network. Networking involves the study of the best way of implementing a network. Much work has been done to find the best protocol, or method, for doing so. It involves a lot statistical/ probability calculation. We really can't tell how it's put to use in real world scenario so we need statistical models.
Looking at modern EE, researchers have basically looted libraries looking for abstract mathematics done in the last few hundred years. Each abstract mathematical theorem somehow finds its use in EE. Even wavelets , which have revolutionized signal processing , were discovered by mathematicians early in the 20th century .

Moving on to higher order concepts,

1.Graph theory in power plant design and VLSI circuit design

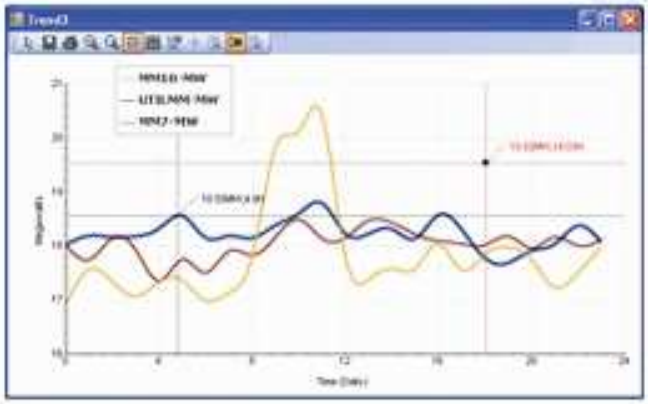
In the year 1847 G. Kirchoff published a paper in which he used graph theoretical concepts to characterize electrical network. Sincde then, graph theory has been used in electrical network theory and analysis. An electrical network system is a collection of physical components and devices interconnected electrically. Thus, network analysis, the basis of network theory, plays a central and essential role in system analysis. A computationally simple and efficient methodology of evaluating the quality index of a thermal power plant (TPP) and of selecting best-quality TPP is based on graph theory, matrix algebra, and permanent models. This takes into account the complexities and interactions of various characteristics of the TPP. The qualitative analysis of a TPP through quality index is proposed by means of conventional and fuzzy set theories.

2.Topology and algebraic geometry - in humanoid robot motion

The results from modern algebraic topology have been used to obtain an improved understanding of the configuration spaces of closed chain mechanisms, leading to improved motion planning for such systems.Robotic system design and many problems in robot task planning can be formulated as optimization problems, though they are typically ``hard'' in terms of complexity and lack of readily recognizable or standard mathematical structures. Success stories include graph-theoretic and calculus of variation based approaches to determining optimal paths, randomized algorithms for finding solutions in complex spaces, optimal feedback control policies for a range of robotic tasks, and saddle-point policies for solving differential games of pursuit and evasion.

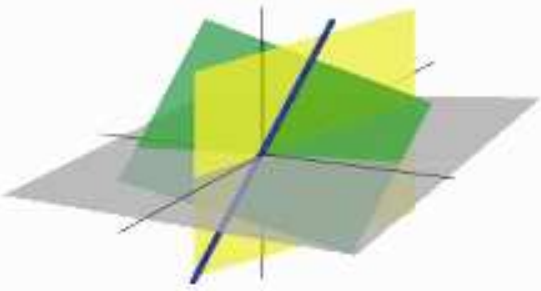
3.Probability theory and vector calculus in algebra for load forecasting

The traditional methods of load forecasting are replaced by collaborative multi-path forecasting that can realize accuracy of the data by means of reducing the random error of the predicted value. The main character of this method is multi-sectored responses, multi-path prediction and multi-program show. This synergetic load forecasting method receives the probability distribution function or the forecasted values and obtains the final high, middle and low forecasting scheme based on the probability theory.



4.Algorithmic game theory and vector space to design optimisation techniques for power plants

Game theory is a discipline that is used to analyze problems of conflict among interacting decision makers. It may be considered as a generalization of decision theory to include multiple players or decision makers.



It is used for solving dynamic transmission planning problems in a deregulated environment. With the restructuring of power industry, various parties enter the electricity market, and open Access to all participants is the basic requirement for the transmission network. In restructured power systems, generation expansion and transmission expansion are planned and decided by separate entities. Transmission planners do not have full access to generation expansion information. To some extent, the incomplete information of generation expansion affects transmission planner's decision. Here, game theory is applied in transmission

planning to simulate generation planner's behaviour and strategies, and obtain transmission expansion decisions that can accommodate various generation expansion schemes.

THE CURRICULUM

There is multitude of areas in electrical engineering where maths finds a prime position. Keeping this in mind the significance of maths in the curriculum needs to be stressed. Many undergraduate mathematics curricula currently supporting electrical engineering programs could be modified to better meet the needs of these programs. What follows are common weaknesses (from the viewpoint of electrical engineering) seen in many mathematics curricula.

1. Too much time and emphasis are placed on topics that are not widely used while topics that have widespread use often receive cursory treatment. One example is the excessive time and attention spent on various solution techniques for ODE. Although they are important, more useful and widely used concepts are Laplace transforms and related techniques.

2. There is often a disconnect between the knowledge in mathematics courses and their application for engineering situations. Examples of mathematical techniques explained in terms of the reality they represent would bridge this disconnect.

3. Current mathematics curricula for engineering are front-end loaded. Consequently, as a matter of timing, many topics are presented too early and cannot be reinforced soon enough through engineering applications before students forget the topics.

4. Failure to utilize appropriate technological tools often encourages memorization and rote algorithm practice at the expense of conceptual and graphical comprehension. Introducing symbolic manipulation programs, e.g., Matlab, MathCAD, Mathematica, Maple, would be valuable to subsequent electrical engineering courses.

5. The first two years of mathematics that support instruction in electrical engineering should present students with conceptual understanding of mathematical disciplines other than just single variable calculus, multivariable calculus and ODE. Other mathematical subjects that are important for electrical engineering students include linear algebra, probability and stochastic processes, statistics, and discrete mathematics.

To conclude, electrical engineering is an exciting and creative profession. Those engineers possessing an understanding and facility of mathematics have an opportunity to be among the most creative of designers. We need to know and to feel how important, how useful, and how meaningful mathematics is.

K.R.RAJBARATH
B.TECH - FINAL YEAR
CHAIRMAN, EEEA

GATE SCORERS IN 2012

Sl.No.	Name of Student	Score
1	Suresh Kumar	1000
2	Kommanaboina Pramod	799
3	Bodhayan Prasad	785
4	Prashant Surana	743
5	Sambhav R Jain	706
6	Robin Watts	695
7	Pradhyumna R	690
8	A Goutham	681
9	Ameen Yasir PA	569
10	Sriharinarayanan MA	459
11	TR Aashish	456
12	Surendra Kumar Tatwal	360
13	P Suresh Kumar	359
14	Ashwin Lakra	353
15	Brajraj Meena	353
16	Arvind Bakodiya	293

COMPANY INTERNSHIPS OFFERED ON-CAMPUS SUMMER 2012

Sl.No	Name of the student	Company
1	Amit Jain	ITTIAM
2	Anand R	ITC
3	Anish NK	Qualcomm
4	Ankit Anand	Tata Steel
5	Gaurav Kumar	IBM
6	Shankar Ganesh	LG Electronics
7	Nithish.K.U	ITC
8	Chandrasekhar.N	Tata Steel
9	Hardik Patel	ITTIAM
10	R.Vignesh	LG Electronics
11	Vivek Sidana	Texas Instruments

TIRUCHY

'Good Scope for Boiler Experts'

Express News Service

Tiruchy: Currents'12, the technical symposium of the the Department of Electrical and Electronics Engineering (EEE), National Institute of Technology (NITT), was inaugurated at the institute's premises on Friday.

Inaugurating the symposium, A Shanmugam, Assistant General Manager/ Human Resource Development Centre (AGM/HRDC), BHEL-Tiruchy, discussed the points to be included in the MoU to be signed by the NITT and BHEL.

He then appreciated the director of NITT for his tireless work to build a research centre and an incubator for entrepreneurship.

Assuring constant support from BHEL, for any event organised by the institute, Shanmugam said boiler manufacturing industries, boiler designing and boiler technology were becoming highly important, as super critical and ultra super critical boilers were highly efficient. Stating that they would opt for ultra super critical boilers when the amount of power to be generated was beyond 800MW and 1000MW, he said, EEE students too would have opportunities to work for power industries or power generation equipment manufacturing industries as robust control engineers.

Though India had sufficient amount of coal for the next 100 years, Shanmugam said, on one hand, the calorific value of coal was too poor and on the other, the available coal possessed high ash content.

"So how to use coal, for the super critical and ultra critical boilers, is the crucial topic to be discussed, as these coal should not emit poisonous gases and other green house gases", he explained.

Any technological advancements that would come in future would definitely be a teamwork. So, the technology should be oriented towards the welfare of the people, Shanmugam added.

Addressing the participants on career opportunities, Srinivasan Sundarrajan, Director, NITT, said students should look forward for career planning as one could not get placements immediately. He then asked the students to analyse whether they were able to get appropriate placements.

BOILER MANUFACTURING, DESIGNING AND TECHNOLOGY ARE BECOMING HIGHLY IMPORTANT. ULTRA SUPER CRITICAL BOILERS ARE REQUIRED TO GENERATE POWER BEYOND 800 MW

Apart from government's investment on super critical boilers, he said, BHEL was exclusively investing ₹1500 crore on the super critical boilers, as nuclear power plants and boiler designing would be the future.

Insisting the students to identify their areas of interest, the director said they should align themselves either with research or entrepreneurship.

"If you(students) are opting for research, then it should be an objective-oriented research. Also, we have to work in the niche area, were others are not working", he stressed.

Stating that a Material Testing Evaluation Centre would be soon built at the NITT's campus, Sundarrajan said the institute and the students should work together to attract both Indian and foreign players to participate in the research programmes. The reputation of the institute, experienced professors and the level of exposure that they witnessed during the four years of study contributed to nearly 90 percent to their market value, the director said. The remaining 10 percent was completely in the hands of the students.

"But if you spend some three or four years of additional time in research, then you (students) will be having a quantum jump", he assured.

One can either opt for industry business or entrepreneurship business but before finalising the decision, one should analyse one's capability and move in the right direction, Sundarrajan suggested.

"We are identifying the core areas for research in each stream and forming multi-discipline research projects, in which students of various disciplines of engineering can participate", the director added.

N Kumarasan, HoD, EEE, NITT, S Moorthi, faculty advisor, V Prashant, chairman, NITT students and students from various other engineering colleges across the state took part.

Currents 12' covered by *The New Indian Express*, dated 3rd March, 2012

OUR ESTEEMED RECRUITERS