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ELECTRICAL ENGINEERING (ELE)

ELE 200201 ALARCON, Louis P. (MS Elec. Eng'g-Microelectronics)
A Study of Data Transfer Mechanisms in a RISC Microprocessor Augmented with a Tightly Coupled Reconfigurable Processing Element (RPE). 2002

This thesis investigates the characteristics and effects of two different data transfer mechanisms between a reduced instruction set (RISC) microprocessor and its attached reconfigurable processing element (RPE). Performance metrics and data transfer characteristics such as throughput and communication overhead of the overall RISC microprocessor system are presented and measured for each data transfer mechanism. Improvements to the two data transfer mechanisms, such as register windowing, and effects of the RPE execution mode are also examined. Finally, simulation results for a simple DLX-RPE system employing these windowing techniques are presented. It is found that windowing techniques improve the performance of the DLX-RPE system, allowing SIMD-like performance with significantly less RPE hardware.

ELE 199602 ANDALES, Zaldy A. (MS Elec. Eng'g)
An Auto-Orienting, Error-Recovering Fuzzy Navigation System for Initially Unknown Environments: Design and Simulation. 1996

The main objective of the study was to devise and integrate fuzzy logic-based auto-orienting and error-recovering schemes for a fuzzy navigation system of an automated Guided Vehicle (AGV) placed in an initially unknown, stationary and flat environment.

As a testbed for simulation, AGV and environment simulators were created. As a basis for the fuzzy navigation rules, the AGV assumed four inputs (three ultrasonic range sensor values and the target direction) and two outputs (AGV direction and speed). A single photo sensor was assumed for detecting targets. A fuzzy navigation system was implemented employing 81 IF-THEN rules.

For the auto-orienting scheme, it was assumed that multiple targets were placed near perimeter walls, and a fuzzy wall-following system was successfully implemented to automatically detect all targets and map out their locations. For error-recovery, a fuzzy spiral search system was successfully devised for recovery from shift and dislocation errors. This strategy required the AGV to scan its vicinity by following a spiral path until the target was found. A fuzzy wall-following search system, on the other hand, successfully provided recovery from timeouts and trap errors. Thus all errors were effectively recovered from with minimal assumed sensors installed. These schemes were integrated with the normal fuzzy navigation system to form the Integrated Fuzzy Navigation system (IFNS). Switching between schemes was managed by an over-all task planner.

To evaluate the IFNS, an A* Heuristic Search-based Configuration Space System was implemented (ACSS). The ACSS, being an optimal path finding technique served as the standard. Results showed that the path efficiency was 84.9899% with respect to the optimal. However, by employing sub-goals or intermediated targets as guides, the path length efficiency improved to 94.7859%. Sub-goals also proved to be effective in eliminating trap and timeout situations.

ELE 199803 ANTONIO, Mia G. (MS Elec. Eng'g)
A Comparative Study of Symmetric and Asymmetric 4-, 8- and 16-State Trellis Coded 8PSK Modulation. 1998

This thesis consists of the modeling, simulation and evaluation of symmetric and asymmetric 4-, 8- and 16-state trellis coded 8-ary phase shift keying (8PSK) modulation techniques in a channel corrupted by noise and amplitude fading, modeled by additive white Gaussian noise (AWGN) and Rayleigh fading, respectively.

The different trellis coded modulation (TCM) systems and channels were modeled and verified through simulation using MATLAB. Performance evaluation was based on the resulting symbol and bit error rates. For each of the 4-, 8- and 16-state trellis coded 8PSK system, the error rates for different values of signal-to-noise ratio (SNR) were determined and plotted. The best system was the one with the smallest value of symbol or bit error rate.

Results of this thesis showed that the symmetric 8PSK signal constellation was better than its asymmetric counterparts in a noisy fading channel for the 4-, 8- and 16-state trellis coded 8PSK modulation schemes. Results also showed that the error rate of asymmetric schemes decreased as the asymmetry angle approached the symmetric case.

ELE 2003 04 BANTUG, Arianne C. (MS Elec. Eng'g- Microelectronics)
A Study of Selective Power-down Optimization Techniques for Low-Power Integrated RISC Execution Unit Design

In this thesis, selective power-down techniques are used for system level optimization. Using these techniques, parts of the system that are idle in every clock cycle are disabled, thus, reducing dynamic switching power. This concept is implemented by clock gating, control-signal gating and disabling output bus drivers. These three techniques were used separately in the execution unit of a DLX-based microprocessor. A quantitative analysis of power savings and tradeoffs were made based on simulations of their schematic implementations. A new optimization procedure is also proposed and implemented resulting in up to 37% power savings. The resulting power savings and area overhead of the optimized designs obtained from both schematic and layout implementations were analyzed and compared.

ELE 200105 BANZON, Peter Antonio B. (MS Elec. Eng'g)
Experimental Analysis of the Performance of New TCP Extensions Over Hybrid Satellite Networks. 2001

This study looks into how new Transmission Control Protocol (TCP) extensions perform on top of a hybrid satellite network and a terrestrial WAN are studied with three different TCP implementations, namely, TCP Reno, TCP SACK and TCP FACK. For both network topologies, data are obtained by actual measurements of file transfers over an operational network.

The first network is composed of the Asian Internet Interconnection Initiatives (AI3) Project's satellite-based network test bed as well as various other networks to which the Advanced Science and Technology Institute (ASTI) is connected. The second network implements a terrestrial Wide Area Network (WAN) setup for comparison.

Analysis of results show that both TCP SACK and TCP FACK outperform TCP Reno for large file transfers. For relatively small transfers, the three TCP implementations have the same performance. Furthermore, TCP SACK significantly outperforms TCP FACK for small file transfers while TCP FACK outperforms TCP SACK for very large file transfers. Overall, TCP SACK is the recommended stack for general purpose applications.

Actual traffic patterns by users of both networks highlight the importance of enhancing the slow start phase of TCP in order to improve the performance of TCP as perceived by actual users.

ELE 200306 BURGOS, Osmon T. (MS Elec. Eng'g.)
Comparison of Classical and Fuzzy Control in Active Mass Damping of a Flexible Structure. 2003

Most research on fuzzy control claim that fuzzy controllers outperformed classical controllers. As an application of control theory, active structure control finds its importance in the enhancement of safety on building against environmental actions such as earthquakes and strong winds. Experimental testing is an important step in the verification of control strategies for structural control.

The purpose of this thesis is to obtain a quantitative comparison of classical and fuzzy logic controllers in the control of a flexible structure employing an active mass damper (AMD) system. Both controllers are optimized and evaluated through simulation in Matlab and implemented in real-time using Real-Time Workshop. The parameters of both controllers are tuned to achieve minimum sum-of-squares of the top floor acceleration. A nonlinear least-squares optimization algorithm, which uses the Gauss-Newton or the Levenberg-Marquardt methods, is used to optimized the controller parameters. A Nedler-Mead simplex direct search method is also used.

Most of the research on active structural control has focused on either full state feedback strategies or velocity feedback strategies. However, accurate measurement of necessary displacements and velocities of a structure is difficult to achieve directly. Accelerations can readily provide accurate reliable measurement of the structural accelerations at strategic points on the structure. Control methods based on acceleration feedback are developed in the minimization of the structure response over sinusoidal and random disturbances.

A classical proportional controller is compared with a single input-output, five-membership function fuzzy controller. The optimizations are done for the proportional gain of the classical controller, the output membership range and the zero output membership width for the fuzzy controller. However, the classical optimized controller outperformed the optimized fuzzy controller in terms of the final objective function: sum-of-squares of the top floor acceleration. Moreover, a plot of the objective function versus the controller parameter shows a monotonically decreasing curve for the classical controller and a convex curve (increasing at low and high values for the controller parameters) for the fuzzy controller.

ELE 199507 CALIBJO, Cirilo C. (MS Elec. Eng'g.)
Tuning of Speed-governing system for Kalayaan Pumped Storage Power Plant. 1995

Changes in system frequency are caused by any imbalance between load and generation. To control these, a speed governor is usually provided. The change in frequency maybe either stable or unstable depending on the values of the parameters of the plant and governor.

This paper describes a simple analytical procedure of tuning electro-hydraulic P.I.D. Governors for the units of Kalayaan Pumped Storage Power Plant. Mathematical analysis is carried out using MATLAB simulation software, while validation through time simulation is performed using Power System Simulator/Engineering (PSS/E). Optimum gain settings were found both during isolated and grid operations. Although actual plant testing was not possible, the result of the study is seen as an improvement from the usual trial-and-error

approach which is currently being practiced.

ELE 200108 CABLING, Aniano C. (MS Elec. Eng'g.)
Demand Forecasting for Distribution Transformer Load Management. 2001

Distribution transformers represent a substantial proportion of the electric system investment. As such, transformer failures generate equivalent economic losses for the electric utility and its customers. Accurately determining the demands of all distribution transformers in service is therefore vital for the efficient management of distribution transformers.

This thesis presents a method of forecasting distribution transformer demand to be used in transformer load monitoring system. Forecasting equations for distribution transformers serving residential, commercial and mixed customers were derived from customer billing data. Unmetered components of energy consumption such as technical loss, streetlights consumption and non-technical losses like electricity theft and pilferage were also considered in the development of forecasting equations.

ELE 199709 CASTILLANO, Gregor C. (MS Elec. Eng'g.)
Search and Modification of ARQ Protocols for Point-to-Point Communication Channels with High Error Rate. 1997

In data communication systems over a channel in which error rate is very high, reliability of the data transmission is one of the main concerns. Error detection incorporated with automatic-repeat-request (ARQ) techniques are widely used for error control. This method is simple and provides high system reliability.

The first part of this study compiles the different versions of automatic-repeat-request (ARQ) protocols gathered from different international journals, published international papers and books. I this part, the performance of different ARQ protocols for point-to-point data

transmission over half-duplex and full-duplex channels are analyzed and compared. The results of comparison are used to determine which of the different versions of ARQ protocols being analyzed are workable over high error rate communication channels. Throughput determination and analysis are also discussed in this study.

The second part of this study presents some techniques that modify Go-back-N and Stop-and-Wait ARQ protocols with the aim of increasing the throughput efficiency under high error rate conditions with less additional complexity in system implementation. The proposed modifications of the two ARQ protocols are performed by theoretical analysis. The results of ARQ protocols modification show improvement of the throughput efficiency of communication channels under high error rate conditions. The three main ARQ protocols used in this study are the stop-and-wait (SW), go-back-N (GBN), and selective-repeat (SR) ARQ protocols.

ELE 199710 CASTILLO, Rajah K.J.C. (MS Elec. Eng'g.)
"QPSK, IJF-OQPSK and XPSK ---- A Comparative Evaluation". 1997

This thesis consists of the modeling, simulation and evaluation of QPSK, IJF-OQPSK and XPSK modulation techniques given different conditions.

The different modulators and demodulators were modeled. The bit error rate (BER) performance degradation of QPSK, IJF-OQPSK and XPSK due to channel bandlimiting and nonlinearities were determined through simulation using Omnisys. The effects of different detection filters on the BER performance of QPSK, IJF-OQPSK and XPSK were also studied. The effect of varying nonlinearities on the BER performance of the different modulation schemes were also simulated.

Results of the study showed that QPSK, IJF-OQPSK and XPSK have similar BER performance under ideal channel conditions. The BER performance of QPSK and IJF-OQPSK modulation becomes degraded when passed through channel nonlinearities while XPSK modulation is not effected by channel nonlinearities. A channel with a roll-off factor α of 0.5 gives a better BER performance over $\alpha = 1.0$ and 0.3 in a linear channel. Passive filter detection is superior over integrate and dump (I&D) detection in bandlimited linear and nonlinear channels. A 3rd order

chebychev detection filter performs slightly better than a 3rd order butterworth filter.

ELE 200111 CHAINANI, Edward T. (MS Elec. Eng'g.)
Application of Linear Prediction and Rapid Acquisition to Nuclear Magnetic Resonance. 2001

In pulsed nuclear magnetic resonance (NMR) spectroscopy, information is obtained by perturbing the nucleus from its equilibrium position and acquiring the transient response. Fourier transformation is then used in data processing of the signals due to its rapid computation of the NMR spectrum. To obtain good signal-to-noise ratio, it is common practice to average many transients. To obtain good resolution, lengthier acquisition times are favored. For insensitive nuclei were thousands of collected transients are necessary, this is a time-consuming procedure, especially if the nuclear relaxation time constant is in the order of seconds or minutes.

A faster acquisition method is proposed in this thesis. The proposed method acquires signals more rapidly than by conventional acquisition methods; however, the signals are truncated. This method is based on Driven-Equilibrium Fourier Transform (DEFT) in which the nuclei, once perturbed, are immediately returned to equilibrium. In processing truncated data, the shortcomings of the Fourier transform must be overcome by alternative spectral estimation methods. An alternative processing method --- linear prediction (LP) --- is sought to reconstruct the spectrum from the incomplete time-domain magnetic resonance data.

The LP method fits the NMR model function consisting of exponentially damped sinusoids with arbitrary frequency, amplitude, damping factors and phases to the data. The fitting can be carried out by a linear least-squares (LS) procedure, and thus does not require starting values, unlike some methods. By using singular value decomposition (SVD) as the basis of the LS procedure, it is possible to distinguish between probable signal components and noise. By using backward linear prediction, the method is insensitive to truncation at the end of the signal, and renders the missing portion unnecessary. Unlike Fourier transformation (FT), truncated data in LP does not necessarily lead to loss of frequency resolution. The LP method's application to truncated,

fast acquisition of data based on the DEFT pulse sequence is discussed in detail. This combination of methods is a novel way of acquiring and processing NMR spectroscopic data.

ELE 200312 CHING, Gilbert S. (MS Elec. Eng'g.)
Microwave Characterization of *"Palay"* at 2.45GHZ. 2003

The objective of this research is to characterize *palay* or rice grains (with husk), specifically the C4 variety at 2.45GHz with varying temperatures and moisture contents and compare the results with parallel works on other materials like wheat, corn, oat and soybean.

The complex permittivity is used to characterize the *palay*. The complex permittivity is measured using a coaxial slotted transmission line. The *palay* is placed in a sample holder and used as the load. A 2.45GHz, 1 khz amplitude modulated wave is used to excite the load and the reflection of the wave is measured by a standing wave ratio meter using the double minimum method. This value together with the shift in minimum caused by the load from a reference short, is used to compute for the terminating impedance of the slotted line, from which the complex permittivity of *palay* is extracted.

Varying temperatures are achieved by controlled heating of the sample holder and different samples with different moisture contents are used.

The measured complex electric permittivity, Є'-jЄ" ranged between 1.8 for Є' and 0.2 to 0.4 for Є" for moisture contents from 3% to 15% and for temperatures ranging from 23ºC to 80ºC.

The argand plot of the complex electric permittivity of *palay* divided by the bulk density show that the points lie near a straight line. Increasing temperatures and moisture contents move the points up the line and decreasing temperatures and moisture contents move the points down the line. The density independent permittivity function plot versus temperature and moisture content show that the points lie near a plane. These results are similar with other grains like wheat, corn, oat and soybean.

ELE 200013 CHUY, Oscar Y., Jr. (MS Elec. Eng'g.)
A Quantitative Comparison of Classical and Fuzzy Controllers Using ISE Criterion. 2000

Classical controllers such as PID still play an important role in our industries and about 90% of the existing industrial controllers are of that kind. Recently, fuzzy controllers have gained interest due to some of its advantages such as; better performance with nonlinear plants and robust performance under parameter variations and load disturbances. Mot of the research on fuzzy control claim better performance over classical control. For this new technology, it is important to rigorous determine its value relative to classical controllers. We need to quantify and verify anecdotal and qualitative evidence that fuzzy controllers outperform classical controllers especially on plants with nonlinear and unmodeled dynamics when both operate at t heir optimum performance.

We aim to develop the technique for quantitative comparison using an optimal tuning of classical and fuzzy controllers based on a specific performance index. We will evaluate the performance of these controllers through simulation and experimentation. We will consider ISE or integral of the square of the error as the performance index. The parameters of the classical and fuzzy controllers will be chosen for minimum ISE. The system we will use for evaluation is a speed control system with some nonlinear control element such as saturation. The actuator of the system is a DC motor. The development, optimization, and evaluation will be done first in MATLAB through simulations and then as a actual implementation using a MATLAB's real-time workshop.

ELE 200214 CO, Melvin O. (MS Elec. Eng'g.)
Prosody Development for Filipino Text-to-Speech Systems

Prosody is the aspect of speech that gives linguistic information at a suprasegmental level, which aids in the comprehension and intelligibility of speech. Prosody is composed of the microprosodic component and macroprosodic component. Microprosody is influence by individual speech sounds while macroprosody is a speaker's choice of intonation. In this research, an automated macroprosody overlay for Filipino Text-to-Speech (TTS) system was developed. Samples of selected natural

utterances of Filipino sentences was collected, pre-processed, transcribed at the word level and analyzed for macroprosody of continuous speech. In addition, isolated utterance of Filipino words was gathered, which serves as the speech corpus for the TTS system. When a sentence or phrase is typed, utterance of each word is obtained from the speech corpus. In order for the synthesized speech to sound natural, appropriate pitch and duration obtained from the gathered Filipino sentences are applied through the use of a concatenative synthesizer called Time Domain Pitch Synchronous Overlap-Add (TD-PSOLA) technique.

Acceptability test show that the Filipino TTS system comparable to some commercially available English TTS systems. Furthermore, Declarative/Interrogative test confirms that macroprosody was captured by the synthesized speech.

ELE 199615 DELLOTA, Ronoel M. (MS Elec. Eng'g.)
Short-Term Load Forecasting of the National Power Corporation and the MERALCO Power Systems Using Artificial Neural Networks. 1996

The main purpose of short-term load forecasting (STLF) is to predict the hourly loads a few hours to a few weeks in advance. Precise STLF represents great savings for electric utilities because the load forecast is used to control operations decisions such as economic dispatch, unit commitment, scheduling of fuel purchases, security analysis and short-term maintenance scheduling.

In this regard, an artificial neural network (ANN) based short-term load forecasting is developed and implemented to predict the hourly electric load of the Luzon grid of the National Power Corporation (Napocor) and the Meralco power systems one day to one week beforehand. In addition, a procedure to forecast the daily peak load of the franchise area of Meralco one day in advance is also presented.

Two years of historical load and weather data are used for creating the training and testing patterns. The ANNs are then employed to learn the implicit non-linear relationship among the past, current and future weather variables and loads. A multilayer feedforward neural network model is designed and tested in this study and the backpropagation algorithm with adaptive learning rates is utilized to train the ANNs.

In this research hourly load forecasts for a one week period were made using the ANN model. For Napocor, an average forecast error of 2.33% was attained. For Meralco, an average forecast error of 2.31% was reached. For peak load forecasting, an average forecast error of 1.98% was achieved by the ANN model that was used to predict the morning peak load of the Meralco franchise area for a one month period.

The results indicate that the ANN-based load forecasting technique gives robust and more accurate forecasts compared with the methodologies that both utility companies are currently using.

ELE 199916 DIZON, Robert O. (MS Elec. Eng'g.)
Sensorless Closed-Loop Control of Hybrid Stepper Motors with Current Regulation

Current control of hybrid stepper motors in a sensorless closed-loop configuration is examined. Rotor position detection is done by monitoring phase current decay times as a result of using a chopper drive. It is shown that with a variable current reference chopper drive, three main performance characteristics of the stepper motor can be improved namely: 1) missed steps due to resonance can be eliminated by the closed-loop nature of the system; 2) efficiency can be enhanced by applying only the right amount of current to drive the load as opposed to always applying full rated current; 3) torque ripples can be reduced by closed-loop microstepping. The paper includes the result of an actual implementation of this scheme. A chopper drive circuit with adjustable current reference that can handle hybrid stepper motors up to 15W is designed and constructed, along with a PC based card that can measure phase current decay times. These circuits, along with accompanying control software demonstrate the feasibility of this scheme for a range of motor speeds. Though the scheme theoretically will work up to the nominal speed of the stepper motor, it is shown that high speeds may require measurement circuits that are more precise and data acquisition and processing systems that are faster than those employed in this research.

ELE 199617 FESTIN, Cedric Angelo M. (MS Elec. Eng'g.)
Verification of the AX.25 Link-Layer Protocol Using Place-Transition Petri Nets. 1996

This study is an investigation of the use of Place-Transition Petri nets or simply, Petri nets, in modeling and in analyzing communication protocols. The AX.25 Amateur Packet-Radio Link-Layer Protocol Version 2.0 was used as the case study of this thesis. Petri net models were built for the link connection establishment phase, the information transfer phase, the frame rejection phase, and the link disconnection phase of the AX.25 link-layer protocol.

In the study of communication protocols using Petri nets, three properties are of interest, namely, boundedness, safety, and liveness or the absence of deadlocks. The main technique for analyzing these properties is the reachability analysis. Reachability analysis is based on exhaustively exploring all possible outcomes the protocol may achieve. One problem associated with this method is the "state space explosion." There are two approaches to solve this problem. The first one is to partition the Petri net model to smaller components so that reachability analysis can be performed. The second approach is to reduce the model into a simpler but equivalent model. This method is called the reduction technique. Both of these approaches were used in this investigation.

Pesim, a Petri net software tool, proved invaluable as an aid to the analysis of the Petri net models. The analysis shows that the models for the link connection phase are deadlock free, bounded and safe. However, the analysis for the information transfer phase shows it is deadlock free, 3-bounded but unsafe. With these findings, it can be said that the AX.25 link-layer protocol is deadlock free, n-bounded, and unsafe.

ELE 200018 GACUYA, Lambert M. (MS Elec. Eng'g.)
A Solution to the NPC Luzon Grid Unit Commitment Problem with Minimum Energy Off-Take Constraint. 2000

The complexity of modeling Minimum Energy Off-Take (MEOT) constrained Unit Commitment (UC) Problem is that it is time bound while, strictly speaking the economic dispatching problem is not. The current priority list scheduling methodology of the National Power corporation

(NPC) treats MEOT constrained units a as ordinary thermal units. The unit's energy fee is added to its full load average cost in preparing the relative merit order ranking and establishes units to be committed every hour. This simplified assumption however logical, is not capable of looking ahead the planning horizon. Thus, the current practice is considered to be the best estimate but not necessarily optimal.

This study attempts to establish an appropriate and realistic model of the Luzon grid with MEOT constraint and to recommend strategies that will realize potential savings or cost reduction for NPC. The MEOT constrained UC problem will be modeled mathematically and solved by treating MEOT constraint as a fuel-limited dispatch problem.

ELE 199619 GALICA, Eric Paolo T. (MS Elec. Eng'g.)
An Artificial Neural Network Based Human Fingerprint Classification System: A Comparative Study. 1996

This thesis seeks to compare the performance of three artificial neural network architectures with respect to the problem of fingerprint pattern-level classification. This comparison is limited by an observation based on 30 sample points. The observation domain was limited to 30 sample points due to the penalty of long training times needed by the artificial neural networks. Pattern-level classification for fingerprints is the first step for full classification according to the Henry System classification method which is currently being used by most law-enforcement agencies. The different artificial neural network architectures were compared according to accuracy and recall times.

The image preprocessor included in the Pattern Level Classification Automation System for Fingerprints (PCASYS), a project by the National Institute of Standards and Technology (NIST) of the United States, was used to provide uniform inputs for the three architectures. Also, the Probabilistic Neural Network used in PCCASYS was chosen as the benchmark upon which the other two architectures will be tested upon. As such, the two network architectures studied and simulated were the Backpropagation network with a Sine activation function and the Neural Tree Network.

ELE 200120 GALVAN, Manuel M. (MS Elec. Eng'g.)
Calculation of Transmission System Losses Using Artificial Neural Networks. 2001

Utilities are now operating or will soon be operating in a new environment where they need to efficiently manage and operate their power systems. The importance of accurate and rapid calculation of losses in the transmission system is thus highly desirable. The cost of losses has become an important consideration in the pricing of energy transactions among interconnected utilities and in evaluating alternative planning and operating strategies.

Present methods of calculating losses are, however, at best mere estimates, underscoring the need for a more accurate and rapid method that would serve the interest of electric utilities under a competitive environment. A fast yet accurate loss evaluation methodology using Artificial Neural Networks (ANN) is presented and implemented to calculate the hourly capacity losses in MERALCO's transmission system. Furthermore, energy losses were calculated by integrating the hourly capacity losses over time.

Training and validation of a three-layer feedforward ANN were done using Pathfindmer, a PC-based neural network simulation software which uses an improved backpropagation training algorithm called Extended Delta-Bar-Delta. Input data to the ANN include hourly load data power deliveries at the generation stations and at the interchange points. An iterative solution of pruning unnecessary input variables was also developed for a more compact network that learns faster and produces a more accurate output.

The hourly capacity losses computed through the use of the ANN-based technique were accurate and very close to the equivalent output from load flow simulations. Maximum percent error of individual hourly capacity losses did not exceed 5% and the average absolute percent error is less than 2%. Also, energy losses for a sample 24-hour period were computed with less than 1% deviation.

A trained three-layer feedforward ANN model proved to be suitable to calculate hourly capacity losses accurately and at fast speed, with the hourly capacity losses as a function of the hourly load and the power

deliveries at the generation stations and interchange points. Results also show that a smaller network with a lesser number of inputs and hidden nodes tended to generalize better.

ELE 200021 GAMBOA, Reynato A. (MS Elec. Eng'g)
Load Management Program for Batangas II Electric Cooperative, Inc. (BATELEC II). 2000

The Batangas II Electric Cooperative, Inc. (BATELEC II) serves the southwestern part of Luzon covering a total of seventeen municipalities. All electricity required are purchased from the National Power Corporation through bulk power delivery points at a temporary one year renewable contact.

The growth over the last few years brought about by the CALABARZON projects has started to exert some strain on the cooperative's existing facilities causing voltage fluctuations, and therefore increasing system losses. System overloads frequently result in power interruptions. To date, new large load applications have already totaled 119 MW.

This study proposed load management programs like Backup Generator Program and Curtailable Service Agreement which could be tapped as complementary resource options to mitigate power increases. These peak clipping programs were intended for large commercial and industrial customers with monthly energy consumption over 1500 kWh to use their on-site backup generator installations or switch off their non-essential loads during system peak period when requested to do so.

The programs were found to be cost-effective from the point of view of the participants, the utility, and the society in general. The Backup Generator Program could provide over twice benefits as its costs for the participating customers and over nine times benefits as its costs for BATELEC II. Similarly, the Curtailable Service Agreement could also provide over twice benefits as its costs for participating customers and over five times benefits as its costs for BATELEC II.

Another key objective of BATELEC II to reduce its system losses and improve the power factor to within acceptance levels. Some of its metering points experience significant energy losses ranging from 27% to 39%, while others have low system power factor that incurred to penalty

charges for the cooperative. The load-logger report also showed that many feeders have highly unbalanced loads.

To address these problems, strategic conservation programs like Loss Reduction Program and Power Factor Improvement Program were likewise proposed. In the Loss Reduction Program, technology options like replacement of primary feeder conductors with larger ones, adding additional phases to existing lines, and improvement of the phase balance were presented, while the Power Factor Improvement Program considered the installation of capacitor banks close to load centers of various metering points.

The cost-benefit analysis conducted for these programs showed significant reduction in energy losses and improved system power factor which provided incentives for the cooperative, while investments could be recovered in few months.

ELE 200322 GUTIEREZ, Ma. Cecilia N. (MS Elec. Eng'g. - Micro-electronics Option)
A Study of the Effects of Layout on RF MOSFET Small-Signal Parameters. 2003

The goal of this thesis is to study and analyze the effects of layout on RF MOSFET small-signal parameters. Using TSMC's 0.25 μm CMOS process, 50 test structures, which include 46 RF MOSFET's and 4 de-embedding standards, were implemented and fabricated. RF MOSFET's, representative of various layout techniques, were implemented in both common-source and cascode configurations. All RF MOSFET's were placed inside a test fixture with GSG probe pads. The other four structures (open, short1, short2, and thru) are standards required by open and three-step de-embedding. A Micromanipulator (with microwave coplanar GSG probes) and a network analyzer were used in measuring the S-parameters of the fabricated RF MOSFET's. The bias voltages were provided by a parameter analyzer, along with a bias tee. Results of pad parasitics de-embedding and RF MOSFET parameter extraction were presented. The effects of gate geometry, number of fingers, placement of substrate contacts, routing scheme, and dummy structure on the extracted parameters were collated and analyzed. Finally, the effects of cascode width on the transistor gain and its reverse isolation were presented.

ELE 200323 HIZON, John Richard E. (MS Elec. Eng'g. - Microelectronics)
A Study on Planar Inductor Coupling on a 0.25 μm Epitaxial CMOS Process. 2003

CMOS is being considered as a potential technology in the development of personal communications system in the low Ghz range. With the integration of RF systems in CMOS, planar inductors will have a crucial role on the performance of the system as a whole. In this study, the degree of coupling between two adjacent inductors is examined. The inductors were implemented using a 0.25 μm epitaxial CMOS process. Coupling mechanisms considered in this study were magnetic coupling and substrate coupling. The amount of coupling is determined by measuring the s_{21} parameter between the inductors implemented. The effectiveness of several isolation structures reported in literature in reducing coupling between inductors was evaluated. These isolation structures include patterned ground shields and halo substrate contacts. From the measured results, it is found that a diagonal configuration improves isolation by 5 dB compared to a horizontal configuration. Furthermore, patterned ground shields are effective in improving the isolation between adjacent inductors.

ELE 200224 JALANDONI, Jenny I. (MS Elec. Eng'g.)
A Solution to Unit Commitment Problem for Small Island Grid with Intermittent Wind Power Supply. 2002

It is difficult to operate a system economically if the power supply and load demand are varying, one of which is a Small Island Grid with intermittent wind power supply. This problem combined with physical and operating constraints is a Unit Commitment problem.

A method using Autoregressive Modeling, Combinatorial Analysis, Lambda Iteration, Monte Carlo technique, and Dynamic programming was developed to solve the Unit Commitment problem of a small island grid with intermittent wind power supply. The island grid power supply is composed of a Diesel units and wind Energy Converters (WECs) only.

Several technical constraints were applied; the significant among them were capacity, diesel minimum loading, wind penetration factor, and hardware availability.

The method divides the total simulation period into time intervals. And for every time interval, it predicts the wind power generation, evaluates the availability of the units (due to preventive maintenance and random breakdown), uses dynamic programming to determine the Diesel unit commitment, determines the optimum WECs combination using Combinatorial analysis, and economically dispatches the Diesel plant load using Lambda iteration method.

The result of this research is a realistic algorithm, that can determine in advance what WECs and Diesel units would be operating economically in a certain time but satisfying physical and operating constraints.

The proposed algorithm was applied to the main island of Palawan province as a case study.

ELE 199425 LAMDAGAN, Ray Afonso G. (MS Elec. Eng'g.)
A Solution to the Frequency Regulation Problem in the Luzon Power Grid. 1994

The Luzon power grid is encountering a frequency regulation problem in which a solution is being sought. Dynamic models of the power system, the speed governing system and the different types of prime movers are set up as block diagrams. A set of first order linear differential equations are formed based on these block diagrams and are solved using numerical integration methods. The dynamic response of the Luzon grid with the present method of frequency control are determined using these models and results show the present method could not prevent Automatic Load Dropping (ALD) for a generation loss of more than 82 MW and could not maintain the frequency deviation within the +/- 0.2 Hz limit.

The new method of load-frequency control for the Luzon grid is basically to operate the two existing automatic load-frequency control systems. These two systems, which have different purposes, are the automatic generation control (AGC) which is the secondary or supplementary control system. Fast frequency decay caused by generator tripping is arrested by these speed governors. But the action of these speed governors alone could not restore the frequency error to zero. It is the supplementary control that slowly brings the frequency back to 60 Hz.

The steady state frequency error is smaller if the system static gain is high (more units are operating on free governor). Automatic Load Dropping (ALD) could be prevented if the static gain is equal to the size of the generation loss divided by 0.4 and if there is an effective spinning reserve or frequency regulation reserve equal to the generation loss. These frequency regulation reserves can be brought into the system quickly through governor action.

Computer simulations show that during periods of low static gain and low frequency regulation reserve, ALD could be prevented by automatic shutdown of the Kalayaan pump-storage plant.

In this paper, guidelines for setting AGC unit and system parameters are formulated and tested on several simulation runs to satisfy the following objectives 1) no control overshoot 2) minimize unnecessary control and chasing of high frequency random load changes. 3) better tracking of economic dispatch targets 4) smooth and lesser frequency excursions. Simulation results show that proper setting of AGC parameters will minimize unnecessary control of units and therefore result in less wear and tear, and that frequency control with economic dispatching of thermal plants is feasible.

Actual results show that the system performance, based on the NERC criterion, of the new method of frequency control is superior to that of the old method.

ELE 200026 LIMCANGCO, Naomi O. (MS Elec. Eng'g.)
An Iterative Modeling Technique for the Two-Phase Eight Winding Hybrid Stepper Motor for the Calculation of Instantaneous Torque Including Magnetic Saturation. 2000

An iterative model for the two phase eight winding hybrid stepper motor has been derived. The new model includes three magnetic effects – magnetic saturation, detent torque and variable reluctance. It was then used to find the instantaneous torque profile using ideal conditions. The simulated torque was compared in form with an experimentally determined torque profile and was found to conform (to a certain degree) with the empirical torque.

ELE 200327 LOZADA, Gerardo V. (MS Elec. Eng'g.)
Optimum Substation siting Using A Gradient Method. 2003

This study develops a new method for determining optimum future substation locations for long-range system capacity planning purposes using a cost object function minimized via a gradient method. The gradient is then solved numerically using a Newton-Raphson algorithm. the Net Present Value (NPV) of annual line losses as a function of the substation location in relation to its service area loads. Previous substation siting methods relied on load moment computations with no cost object functions to prove optimality. Results of several test runs on actual Meralco forecasted substation load data indicate improvements over traditional load moment methods can be realized in terms of minimizing long-term costs.

ELE 199328 MANGASER, Ramon A. (MS Elec. Eng'g.)
Automated Design Optimization of CMOS VLSI Operational Amplifiers. 1993

This thesis proposes and implements an algorithm that eliminates the tedious design iteration of the circuit design phase of MOS op-amps. The proposed algorithm automatically computes for the required optimized design of the op-amp from the design specifications and the analytical model of the op-amp. It is a combination of two algorithms: namely, Simulated Annealing and Nelder and Mead's Simplex Algorithm. The combination offers certain advantages: first, it is independent of the initial choice for the solution which is a common fault of ordinary optimization algorithms and second, it is faster than pure Simulated Annealing which takes a long time (due to the large number of iterations needed) to arrive at an optimum solution.

ELE 199429 MANZANO, Enrique M. (MS Elec. Eng'g)
Optimization of Concentrator Locations and Station Assignments in an FDDI Dual Ring of Tress Topology. 1994.

There are many LANs in competition today with standards ranging from CSMA/CD, Token Bus, Token Ring, Timed Token Ring, and others. Ethernets are a popular choice, ATMs are promising. Fiber Distributed Data Interface (FDDI) boasts of a performance that exceeds Ethernets, an OSI architecture that assures multi-vendor interoperability, and available and cheap technology compared to ATMs.

The most versatile FDDI topology is the dual ring or trees. The backbone is composed of dual attachment concentrators that form a dual counter-rotating ring. The local access is composed of concentrators that cascade down from the ring. Stations can be connected to any concentrator (ring, or local access).

The purpose of this thesis is to develop an algorithm for a dual ring of trees topological optimization. It combines several published algorithms with the author's innovations. The program generated uses three major procedures. The first optimizes the ring, a problem similar to the Traveling Salesman Problem (TSP), an NP complete problem; the second optimizes the spanning forests of concentrators; and the third optimally assigns the stations to the installed concentrators. The main program that conducts the three mentioned procedures plus some minor procedures is an algorithm that this author calls a "drop within a drop algorithm".

Software is provided in window friendly environment very similar to the Borland's Turbo Pascal in which it was developed. As a test case, the U.P. Diliman campus FDDI network is constructed.

The author sees the importance of this work not only in the 100 Mb/s, 500 station FDDI dual ring of trees but to larger future networks like the FFOL (FDDI Follow-On LAN) which is on the drawing board that may boast of 2 gigabits/s bandwidth (plus an increase in stations) and other networks that may choose to adopt the dual ring of trees topology.

ELE 200330 MATERUM, Lawrence Y. (MS Elec. Eng'g-Computer & Communications)
Estimation of the Wideband Interference Nulling Capability of a Linear Equi-spaced Antenna Array Having a Tapped Delay Line Beamformer. 2003

One measure of how ell a particular adaptive antenna array configuration performs is its capability to reject interference signals in order to meet a certain performance goal. When the interference signals are wideband, the determination of the nulling capability of the antenna array is not as straightforward. In this research we attempt to quantify the maximum number of wideband interference signals that can be sufficiently nulled, under severe interference scenarios using a tapped delay line beamformer with a fixed number of antenna elements. This objective was accomplished through computer simulations where the performance of the tapped delay line beamformer is evaluated under various parameter settings and subjected to various interference scenarios. It is shown that increasing the delay between taps does not contribute to improving the nulling capability. For increasing fractional bandwidth more taps are needed but to a certain limit. Also the results show that under severe interference scenarios, the maximum number of wideband interference signals that an array can sufficiently null with the minimal number of taps cannot improve beyond *M-2*.

ELE 200131 MELENDRES, Jose Mari P. (MS Elec. Eng'g)
Reliability-based Maintenance Scheduling of Power Circuit Breakers for Overhead Distribution Feeders. 2001

Maintenance policies are established with the objective of reducing forced outages due to equipment failures, mitigate its consequences and improve the availability and reliability of its plant physical assets. These preventive maintenance are scheduled to conduct maintenance activities at the right time and frequency.

A new technique in establishing maintenance schedules is developed in this study using the probabilistic reliability models of Power Circuit Breakers (PCBs), the expected fault magnitude in feeders, and the accumulated interrupting capacity of the breaker. The reliability analysis

conducted for power circuit breakers used in overhead radial feeders of an electric distribution utility had shown that the power circuit breakers under a time-based maintenance scheduling program were failing at random. On the other hand, the breakers exhibited an increasing hazard rate from the point of view of tripping operations, i.e., the probability of failure increases as the breaker tripping operations to interrupt line faults increases.

The proposed method was implemented in a computer program and the method, as applied in a distribution system, results in an appropriate and effective maintenance schedule of PCBs.

ELE 199732 MONJE, Jose Claro N. (MS Electrical Eng'g- Computer & Communications)
Dynamic Walking Simulation and Balancing Characterization of a Fuzzy-Controlled Penta-Limb Biped Robot. 1997

The mathematical dynamic model of a single support leg penta-limb biped robot is complicated to use and solve in a conventional control system. Not only is this multivariable, but it also involves simultaneous variable-coefficient second-order nonlinear differential equations that may not yield closed form equations and thus be unsolvable.

A fuzzy controller, on the other hand, can make the robot walk forward or stop and balance itself. The fuzzy controller can decide on the robot's next movement without using any mathematical model, and thus avoid the complication of having to solve control system equations.
This thesis proposal aims to demonstrate this by simulation of the robot's walking and stopping movement.

ELE 200333 NOCHE, Joel R. (MS Elect. Eng'g- Microelectronics)
An Asynchronous Single-Precision Floating-Point Arithmetic Unit. 2003.

A transistor-level design of an asynchronous single-precision floating-point arithmetic unit is designed and tested using Cadence software. It uses CMOS (complementary metal oxide semiconductor) and DCVS (differential cascade voltage switch) logic in a 0.35 μm process. Dual-rail signals are used for data, and control signals use four-phase

handshaking and are mostly single-rail. Layouts of some of the unit's datapath and control blocks are created and tested.

The unit handles single-precision addition, multiplication, division, and remainder using the IEEE 754-1985 Standard for Binary Floating-Point Arithmetic, with rounding and other operation to be handles by separate hardware or software. Division and remainder are done using the restoring subtractive algorithm; multiplication uses an additive algorithm. Exceptions are noted by flags (and not trap handlers) and the output is in single-precision.

Previous work on asynchronous floating-point arithmetic units have mostly focused on single operations such as division. This work performs four floating-point operations using a common datapath. As such, it can serve as a basis of comparison for future work.

ELE 199634 OCHAVE, Victorio E. A. (MS Elec. Eng'g)
Nonlinear Modeling and Circuit Optimization of GaAs MESFET Oscillators. 1996

A nonlinear optimization procedure to design power-optimum GaAs MESFET microwave oscillators is investigated and implemented in this thesis. The method aims to eliminate the empirical nature of microwave oscillator design. To carry out the procedure, a large-signal GaAs MESFET model is constructed; the model simulated device breakdown and accounts for the frequency dispersive behavior of output conductance. A direct extraction of small-signal model elements is undertaken, while large-signal model parameters are obtained using a simultaneous fitting of measured device DC and RF data to nonlinear expression representing the bias dependence of model elements. A modified annealing optimizer in conjunction with a quasi-Newton scheme is employed in the extraction of the large-signal model parameters.

The harmonic balance method is used to compute the steady-state terminal currents, while a coupled random-gradient optimizer is used to search for the optimum device port voltages that will induce the device to operate at pre-specified conditions.

The nonlinear design method is shown to result in GaAs MESFET oscillator designs that operate nearer the desired frequency of operation and with higher RF output power, compared to circuits designed using conventional methods.

ELE 200235 OCHE, Jonathan S. (MS Elec. Eng'g)
Polar-Radii Graphs: A Geometric-Invariant, Shape-Based Approach to Handwritten Text Recognition. 2002

In recognizing handwritten texts, one of the major considerations is the inherent variability of human handwriting. The problem of variability in handwriting due to geometric distortion of letters by scale and rotation is addresses in this thesis using the Polar-Radii Graph scheme. Scale and rotation invariant, the PRG image coder is used to encode handwritten texts. The PRG of a handwritten character is a functional representation that can be used to describe and regenerate the character with appropriate accuracy. It shows the relationship between the relative distances from the character's centroid to points along the outer boundary as a function of angle. The handwritten texts are limited to compose only of at most two characters. The characters may or may not be connected. They can be any of the 52 upper and lowercase character classes of the English alphabet.

A handwriting recognizer was developed to implement this problem and was tested using both single and double-character handwritings obtained from 500 different writers. The test for 26,000 single-character handwritings yielded a recognition rate of 90.22%. The test for 1,500 double-character handwriting yielded a recognition rate of 87.08%.

ELE 200336 ORILLAZA, Jordan Rel C. (M. S. Elec. Eng'g)
Analytical Models and Methodology for Segregating and Quantifying Electric Distribution System Losses. 2003

This research developed analytical models and methodology to segregate technical, non-technical and administrative losses of electric distribution systems. Technical losses are quantified through a three-stage approach starting from the secondary network up to the sub-transmission facilities. The non-technical loss is determined from the residual of the total system loss after accounting for the administrative and technical losses.

The models and methodology were applied to two circuits of representative distribution utility- Benguet Electric Cooperative (BENECO) where monthly and annual technical losses were analyzed. The first circuit represents a predominantly residential rural electric service while the second is an urbanized service for both commercial and residential customers.

The output of this research is useful for distribution utilities for their historical and predictive performance assessment. It may also be used and administered by the utility regulator to monitor and benchmark the efficiency performance of electricity distributors. Finally, it is suitable for establishing the caps of recoverable rate of system losses.

ELE 199837 ORTIZ, Noli E. (MS Elec. Eng'g)
Public Key Cryptosystem in Finite Field (*GF(2^n)*) Utilizing Digital Signal Processors and Fast Fourier Transform Techniques. 1998

This thesis involves the development, simulation and testing of a DSP-based, ElGamal *Public Key Cryptosystem* (PKC). PKC's are used to provide security and privacy to data communication systems including data storage and retrieval systems. Current implementations of PKC's are either slow or requires expensive hardware or custom VLSI. PCK in Galois field GF(2^n) utilizing digital signal processors (DSPs) and fast Fourier transform (FFT) techniques offers an efficient alternative to current implementations, especially so for countries where VLSI technology are not yet mature. The DSP-FFT-based PKC in *GF*(2^{1024}) was implemented using the Motorola's DSP56000.

ELE 200338 PEDRASA, Michael Angelo A. (MS Elec. Eng'g)
A Path-Planning Algorithm for Soccer Robots Based on Repeated Modification for Bezier Polynomials. 2003

The objective of an attacking in robot in robot soccer is to kick the ball towards a specific direction with or without the presence of stationary or moving obstacles. A path-planner controls the motion of the robot. This thesis implements a path-planner that is based on repeated modification of bezier polynomials.

The proposed algorithm steers the robot by: (a) selecting the control points that would define the bezier curve, (b) determining the parametric equation from the control points, (c) computing the curvature from the parametric equation and (d) computing the wheel velocities so the robot would move along an arc with equal curvature.

The proposed algorithm is compared to the uni-vector field and line-circle algorithms. These algorithms are already used in robot soccer competitions. The algorithms executed 17 test cases, where each test case is described by the placement of the robot, ball and obstacles. The objective of the robot is to kick the ball towards a specific direction. The performances of the algorithm are compared by comparing the success rate, kicking accuracy and frequency collisions.

The results verified the validity of the proposed algorithm. It showed that the performance of the proposed algorithm is comparable to the performance of the line-circle and uni-vector algorithm.

ELE 200339 PORNELA, Crimson S. (MS Elec. Eng'g- Microelectronics)
A Study of the Effects of Layout Techniques on the Noise Performance of CMOS RF Transistors. 2003

This thesis aims to study and analyze the effects of different layout strategies on the noise performance of CMOS RF transistors. Layout of NMOS transistors were designed and implemented in common-source and cascade configurations using TSMC's 0.25μm CMOS process.

Two general layout approaches were used: the multifinger distribution and cluster of fingers arrangement. The gate geometry of the transistors is varied using single-contacted and double-contacted gate. Substrate contacts are implemented either in guard rings or conventional substrate contacts. For matching purposes, dummy transistors and dummy polysilicon were utilized. The implemented transistors are placed inside a test fixture with ground-signal-ground (GSG) probe pads.

Simulations were accomplished using Cadence SpectreRF, wherein the noise figure and noise parameters can be obtained. Three simulation strategies were used to extend the BSIM3v3 model for RF noise simulation; (1) simulation with calculated R_g, (2) simulation with extracted components (R_g, R_{sub}, C_{db}) and (3) simulation that takes into account the effect of the test fixture and addition of extracted components.

The fabricated transistors were characterized and measured using a micromanipulator with GSG probes, a network analyzer and a noise figure measurement system. From the simulated and measured data, the layout strategies that affect the noise performance of the transistors were determined and analyzed.

ELE 200240 RAYA, Mary Anne D. (MS Elec. Eng'g)
Adaptive of Motion Artifacts in Stress ECG Signals Using Accelerometers. 2002

Electrocardiographic (ECG) signals obtained from stress examinations are diagnostically significant in detecting a number of heart diseases, which may not be apparent when the patient is at rest. However, the noise produces by the environment and by the patient often distorts the ECG data. Motion artifact, the most prevalent and difficult type of noise to filter in exercise ECG, corrupts the intelligibility of the desired signal thus reducing the reliability of stress test.

This research aims to demonstrate a new adaptive method for stress ECG signals. The noise cancellation scheme uses a uniaxial accelerometer, which is placed at the subject's lower back, as a source of noise reference. Experiments involving single-axis and dual-axis motion sensors are conducted to evaluate the efficiency of this technique. The effect of using such number of axes on the degree of filtering of motion artifacts from stress ECG is investigated. The acquired real ECG and accelerometer data are simultaneously processed and analyzed using the two most widely used adaptive filtering algorithms, Least Mean Square (LMS) and Recursive Least Squares (RLS).

The results consistently sow that the proposed method can be adapted to effectively reduce motion artifact in stress ECG by just using a single-axis noise reference. In order to measure the effectiveness of the proposed method, other available methods used in stress ECG signal enhancement are employed and compared with the proposed method. These methods, which address the issue of adaptive filtering motion artifacts in exercise ECG, are the ones proposed and conducted by Tompkins (1995) and Tong (2000).

ELE 200241 RELENTE, Andrei Raymund R. (MS Elec. Eng'g)
Adaptive Filtering of Motion Artifacts in Photoplethysmograms Using Accelerometers. 2002

Noise is a limiting factor in the study of physiological signals. In ***photoplethysmograms*** **(PPGs)**, the most prevalent type of noise is *motion artifact*. Motion artifact occurs when the PPG sensor is subjected to excessive motion. This situation often leads to false pulse rate reading and oxygen saturation information, as well as signal waveform distortion. Our studies indicate that this induced noise is additive in nature and may be present in the same frequency bands as pulse rate. These results motivate the use of adaptive filtering with accelerometers as noise reference to remove this noise. This research focuses on the use of such techniques on filtering corrupted PPG signals and their performance in reducing errors in the pulse rate. Our results show that the proposed adaptive filtering is effective in reducing the motion artifact content of corrupted PPG signals and improving the estimation of the pulse rate to within 5% error compared to above 100% error for unfiltered signals.

We divide the work into three parts: (1) software simulation, (2) physical experimentation and (3) data analysis. For the first part, we generate a synthetic PPG signal and introduced artifact noise using an actual accelerometer signal. To this corrupted synthetic PPG, we apply the MATLAB functions *adaptlms* and *adaptrls*, which implement the *Least Mean Square* (LMS) and the *Recursive Least Square* (RLS) algorithms, respectively. We investigate their performance by varying several key parameters.

For the physical experimentation, we acquire and analyze four signals simultaneously: (1) the raw photoplethysmogram (PPG) signal, (2) the X-axis and (3) the Y-axis accelerometer signals, and (4) the Lead I ECG signal. We use a Nellcor N200 pulse oximeter unit to obtain the analog PPG signal. We use the Analog Devices ADXL105 single-axis accelerometers to obtain the X-axis and Y-axis signals that act as noise reference inputs to the adaptive filter. We place the accelerometer orthogonally to each other on the top of the PPG probe. We investigate the performance of the two adaptive filtering schemes employing single-axis and dual-axis configurations. We use four stress tests proposed by Hayes and Smith [Hayes, 2001] in order to study the effect of motion artifacts in PPGs. These tests are: (1) random bending motion, (2) random

waving motion in the X-axis and (3) Y-axis directions, and (4) random composite motion.

To quantify the effect of motion artifact and evaluate the performance of the adaptive filtering techniques, we computed the pulse rate three ways: (1) from the unfiltered PPG signal, (2) from the adaptively filtered output, and (3) from the ECG signal. In our comparisons, we used the average difference in instantaneous pulse rate and the cumulative averaged pulse rate.

Our results indicate that the best performance for RLS is achieved with forgetting factor equal to 0.9999 and filter order N=32. For the case of LMS, the best performance is achieved with a step size of 0.1% of maximum value and with filter order N=32. Between these two, RLS performs slightly better than LMS. Results also show that using a dual axes accelerometer as noise reference does not present any significant advantage over using a single axis accelerometer.

ELE 200042 ROJO, Marlon G. (MS Elec. Eng'g)
Optimizing Reactive Power Compensation for Unbalanced Distribution Feeders with Fixed and Switched Capacitors. 2000

The study aims to improve the economic performance of three-phase unbalanced distribution systems by optimizing reactive power compensation using fixed and switched shunt capacitors.

The study focuses on the characteristics of rural electric cooperative distribution systems. These systems are characterized by unbalanced loading and unbalanced circuit configuration. Single-phase distribution transformers which frequently are found singly at various load pints contribute to unsymmetrical loading. The presence of V-phase or single-phase circuits and the incomplete transposition of three-phase lines give rise to an unbalanced system configuration. Most of these systems use only fixed capacitors while a number of studies have indicated the economics of using a combination of fixed and switched capacitors.

Previous works have dealt with the reduction of energy loss in primary distribution feeders using shunt capacitors with one or more simplifying assumptions. These assumptions include the following: zero or linear capacitor cost, continuous capacitor size, uniform capacitor sizes, pre-specified number of capacitors, capacitors are of fixed type only, pre-

specified relative positions of the switched and fixed capacitors, constant capacitor output current, simplifies equivalent feeder, uniform cross-section feeder, constant load, uniformly distributed reactive load, reactive compensation affects only the reactive component of the current, constant voltage profile along the feeder, balanced three-phase networks with balanced load, and no mutual coupling effect between conductors. To optimize the savings from the use of fixed and switched capacitors, several studies employ the simplifying assumption that the system is balanced. However, if capacitors are sized and located based on balanced system, the solution could be suboptimal when applied to the unbalanced system.

In order to obtain results of greater accuracy and achieve a cost-effective reactive power compensation for rural electric cooperative distribution systems, the imbalance and other practical characteristics of distribution primary feeders are considered, he possible use of switched capacitors in combination with fixed capacitors investigated, and the investment and operation costs of capacitors accounted for. With these considerations, the study develops for three-phase unbalanced distribution systems a methodology got optimizing reactive power compensation. The optimization methodology includes the determination of the optimal location size, number, and switching-on time of shunt capacitors with economic benefit as the objective function. A three-phase power flow analysis program is integrated into the implementation of the methodology.

ELE 200343 ROSALES, Marc D. (MS Elec. Eng'g)
Characterization, Comparison and Analysis of Monolithic Inductors in Silicon for RF IC's. 2003

Passive components implemented in digital CMOS is one of the major elements in Radio Frequency CMOS research. The chip area this passive component occupies is very large compared to the area covered by the active component. Thus, this is enough reason to make a passive component a significant area of research. In addition, the performance of a passive element like an inductor greatly influences the overall system performance.

This thesis focuses on the design, implementation, characterization and analysis of spiral inductors on a heavily doped silicon substrate using a 0.25 μm CMOS process.

The inductors were designed using Spiral Calc, Asitic and Virtuoso Layout Editor. A total of 23 structures were fabricated on an 8.942 mm^2 die. The inductor test chip consisted a total of 19 spiral inductor structures and four structures for measurement calibration and test structure de-embedding. The inductor structures that were implemented included planar square spiral structures, planar octagonal spiral structures and multi-level square spiral structures. Some of these inductors had Q enhancement structures consisting of patterned ground shield, metal halos, multiple metal layers and a combination of multiple metal layers and patterned ground shield. All inductors were placed inside a test fixture with ground-signal-ground (GSG) probe pads. The additional structures implemented for measurement calibration and test fixture de-embedding included test fixtures with open GSG pads, shorted GSG pads, and thru GSG pads.

The inductors including their Q enhancement structures were characterized using a network analyzer. A Micromanipulator with microwave coplanar GSG probes, a Hewlett Packard network analyzer and post data processing using customized Matlab functions were used for de-embedding and extraction of the inductance, the structure parasitics and the Q-factor of the inductors.

The generated data from the above set-up was used to produce two sets of plots for analysis and comparison. The first set was the set of measured data, where the effects of different de-embedding techniques were compared. The next set plots involved the data generated from simulations using ASITIC, inductance formulas, inductor models and the measured data. The inductor design tools, models and formulas were compared and verified with actual measured data.

ELE 200244 RUBRICO, Jose Ildefonso U. (MS Elec. Eng'g)
Implementation of a Fuzzy-Based Motor Controller on a Behavior-Based All-Terrain Wheeled Robot. 2002

This research implements a low-level fuzzy motor controller in an actual behavior-based wheeled mobile robot. The robot is intended to autonomously perform a pre-programmed task (e.g. travel in a straight line

for about 5 meter and then hide somewhere dark) in varied terrain. The behavior-based approach is chosen for its apparent robustness in unknown and unmodeled environments and the fuzzy-based controller due to the relative ease of controller design it affords even the absence of a complete and precise system model. Wheeled locomotion is preferred over legged locomotion because the former allows less complex control algorithm than the latter and also because it is generally easier to implement mechanically. The robot is tested on various terrain, both man-made and naturally occurring (e.g. corridor floors, parking lots, grassy land, etc.). the performance of the speed controller is evaluated based on its transient and steady-state response characteristics.

ELE 200345 SAVET, Froilan J. (MS Elec. Eng'g)
Voltage and Reactive Power Control Optimization in a Distribution Substation Using Dynamic Programming. 2003

This paper presents a new method for coordinating voltage/reactive power (Volt/VAr) control in a distribution system by using a dynamic programming (DP) approach. The objective of the proposed method is to coordinate the action of substation on-load tap changer (OLTC) and the switching of substation and feeder capacitor banks (CB) that will result in reduced distribution system loss, improved voltage profile downstream, and less tap changer and capacitor switching operations. Voltage limits of 0.95 to 1.05 per unit are imposed on feeder lines while reactive power flow through the main transformer is quantified based on the utility's current power factor (pf) discount/penalty formula.

Given the hourly forecasted real and reactive power loads, and the substation-transformer primary voltage, the proper dispatch of the OLTC taps and CB status for the next 24 hours is determined. Loadflow simulations are performed for every tap position-capacitor status combination. Every combination is regarded as a possible state in the sequential, multi-stage decision process. Dynamic programming is implemented to arrive at the final dispatch.

To demonstrate the effectiveness of the proposed approach, the dispatch strategy is implemented on a typical Manila Electric Company (Meralco) distribution substation. Cubao substation's power transformer (PXF) banks 1 and 2 and their associated feeders, are used as test systems and the results are compared with those obtained using the conventional method used by the Meralco System Control Center.

The results of the simulations show that an optimized dispatching schedule of Volt/VAr control equipment is indeed feasible using the method proposed in this study. Even with daily load variations, it is determined that the proposed dispatch schedule can effectively coordinate the individual settings of the different equipment. These findings indicate that a dispatch strategy using dynamic programming is an effective tool for System Control; one that does not entail any burden of additional investment in equipment by the distribution company. The proposed method only requires operator intervention in the control set-up of the OLTC and capacitor banks.

ELE 200146 SIOSON, Vicente C. (MS Elec. Eng'g)
A Methodology for Scheduling the Economic Purchase of Energy in a Competitive Electricity Market. 2001

The Philippine electric power industry will soon be restructured and become competitive. In this environment, it is imperative that distribution companies purchase energy in the most economic manner to protect profitability and market share.

This study developed a methodology for scheduling the economic purchase o energy. The proposed methodology minimizes the annual energy purchase cost by optimally allocating energy purchases from two types of energy market instruments – bilateral contract and the spot market. It involved the modeling of the load, bilateral contract and spot market characteristics as decision variables on linear programming optimization.

The methodology is applied in an actual distribution system operating in a hypothetical competitive electricity market environment. The computed results generate the optimal schedule of energy purchases from both market instruments. Case studies show that the optimal schedule is sensitive to both to the process of both energy market instruments.

ELE 200147 SUMAYAO, Andres P. (MS Elec. Eng'g)
Development of a Multivariable Model for Calculating Distribution Feeder Losses. 2001

For electric utilities, distribution loss has become an increasing concern because of the growth of load demand and the spiraling cost of energy. Part of most utilities' programs focus therefore on efforts to minimize or control losses in the distribution system, where 70-80% of the losses occurs.

A prerequisite to any loss reduction program is a means to quantify the amount of losses generated on each distribution circuit. Traditionally, this has been done by performing load flow simulations. However, load flow simulations require detailed modeling of each system component and ordinarily takes great amount of data, time, and effort to perform.

This thesis presents a method for developing a model that can be used to approximate the losses computed through load flow simulations. The model does not take into account the non-technical losses such as due to pilferage, billing errors, etc.

According to the typical load patterns and energy consumption of each customer, a load flow simulation is first conducted on the secondary system to obtain the losses on the secondary lines and transformers. The losses and load data found in the secondary are then used as inputs for another load flow simulation on the primary system. Given the sets of loss data gathered from these load flow simulations, a model is developed using multiple linear regression analysis.

Two (2) of Meralco's 24.5 kV circuits were used as reference in the study. One circuit selected has a predominantly commercial load, and the other one has a predominantly industrial load. Both circuits serve a percentage of residential loads.

The results of this study show that by proper selection and combination of parameters, it is possible to come up with a model that can be used to compute the losses in the distribution circuits. Likewise, it has been shown that despite differences in configuration, a common model can be developed and applied to predict the loss among different distribution feeders.

Comparison to the loss values obtained using the model with the losses derived from load flow simulations indicate a maximum error of 2.85% and an average error of 1.63%. Based on these results, it can be deduced that a method to compute losses in a distribution feeder using multiple regression model holds a great promise of becoming a loss analysis tool for electric utility operators.

ELE 200348 TAN, Emerson C. (MS Elec. Eng'g)
Development of a Parametric Speech Model for Wideband Speech Coding. 2003

Wideband speech offers a more natural sounding voice in any telecommunication system. Typical applications include teleconferencing and video-conferencing. Wideband speech covers 50 Hz to 7000 Hz of the spectrum and is sampled at 16 Hz. Various methods for coding wideband speech have been proposed and some have been accepted for standardization. Most of the proposed wideband speech coders are either waveform coders or hybrid coders. Parametric coders offer the lowest bit rates with acceptable speech quality. A wideband speech model is an integral part of a wideband parametric coder.

In this thesis, wideband speech models are developed by extending popular narrowband speech models through the observation of peculiar characteristics in wideband speech. These popular narrowband speech models are the linear predictive model and the sinusoidal model. Several configurations of wideband linear predictive model and wideband sinusoidal model are implemented. Through subjective testing for quality and intelligibility, six configurations are found to be acceptable. These wideband speech models can be used in the future research for the development of a very low bit rate wideband speech coder.

ELE 199349 TARROZA, Antonio Ernesto R. (MS Elec. Eng'g)
Adaptive Powerline Interference Cancellation in Electrocardiography. 1993

Powerline interference, which is of common-mode, causes distortion in electrocardiograph (ECG) readings. There have been several

attempts at removing noise in ECG readings. One of which is through digital signal processing. This thesis aims to study fixed or non-adaptive and adaptive digital filter theories and their application to powerline noise cancellation in ECG signals. The performance of fixed and adaptive filters were studied and compared with one another based on a common set of parameters. Both fixed and adaptive filters had transversal and lattice implementations. The adaptive filter employed the Least Mean Square (LMS) algorithm applied to both transversal and lattice structures. Studies revealed that although the lattice structure holds promise in filtering out powerline noise, the fixed and adaptive LMS transversal filters still enjoyed superior performance over that of their lattice counterparts.

ELE 200350 TE, Archie C. (MS Elec. Eng'g-Microelectronics Option) A Study on Using Dual Supply Voltages for Low Power Design of Datapath Elements for a RISC Microprocessor. 2003

Power consumption has increasingly become a major focus in digital systems design. As the demand for portable applications increases, many low power design techniques have been proposed. Most of these techniques target the dynamic component of power consumption, or the power consumed during switching.

Voltage scaling, which involves reducing the supply voltage, is an effective technique to reduce dynamic power consumption since it takes advantage of the quadratic dependence of power on voltage. However, reducing supply voltage results in increased propagation delay. A possible approach in voltage scaling is to use dual supply voltages to allow parts off the critical path of the logic network to operate at a lower supply voltage while maintaining the same effective speed.

In this thesis, some dual supply voltage techniques are applied to basic adder topologies. Comparisons are made regarding their effectiveness and applicability to datapath elements. A faster procedure is proposed for the selection of low voltage gates. Another procedure is suggested to quantify the cost of level converters. The power saving potential of dual supply voltage adders and datapath elements is analyzed based on simulations. Physical layout tradeoffs are considered.

ELE 200351 UMALI, Edwin (MS Elec. Eng'g)
A Real-Time Test-Bed for the Differential Space-Time Block Code Modulation for Wideband CDMA. 2003

The differential space-time block code modulation for Direct Sequence Code Division Multiple Access (DSTBC-CDMA) system combines the merits of differential detection based on space time block codes and spread spectrum technology for the improvement of the performance of the CDMA system in a fast time-dispersive channel [16]. Simulation results indicate that, indeed, there are benefits in using this new scheme. However, the practical implementation of the new wireless communication scheme was never studied. The required computing power to attain the necessary output data rate and the effect of using a different data representation were never included in the results.

In this research, the new wireless communication scheme is adapted to a wideband CDMA system operating at a chip rate of 3.84 Mchips/sec and an output data rate of 240kbits/sec. simulation results indicate a 13-dB loss in performance when compared to DSTBC-CDMA system. This loss can be attributed to the high autocorrelation values of the spreading codes. The *differential space-time block code deterministic de-prefix* (D-Det-DP) downlink receiver [16] is implemented real-time on a TMS320C6201 evaluation module to study the design issues involved in implementing the new system. The new test-bed can measure the performance of the new system using software/hardware simulation environment. The results using the test-bed validate the results of the simulation.

ELE 199752 VALENTUS, Vincent Peter C. (MS Elect. Eng'g)
Detection of Speech over the Telephone Network. 1997

This thesis seeks to address the problem of detecting the presence of human speech in a short-time segment of a telephone line signal. It consists of the design, implementation, and evaluation of a statistical pattern classifier based on a neural network paradigm to identify speech over a background of silence and other non-speech signals, such as the tones used for the telephone service.

The designed algorithm for speech detection is based on the method proposed by J. Hoyt and D. Wechsler [15] with modifications to process a more suitable wet of signal feature measurements. The classifier uses Radial Basis Function networks to discriminate between speech and non-speech signals. This thesis experimented on two different basis functions for the hidden layer nodes of the network to determine the effects of using the Mahalanobis and Euclidian distance on the performance of the designed classifier. This thesis also examined two different network structures in the desire to improve the reliability of the algorithm to make the two-class decision across a variety of telephone connections.

The practicability of the designed speech detectors is demonstrated by an actual implementation of the algorithms in Matlab. The performance of the detectors is measured using the percentage of correct classification as the basis for evaluation. Results show that a reliable speech vs. not-speech decision, with an accuracy of 99%, can be achieved by using an RBF network with a single output neuron, which uses the Mahalanobis distance in the calculation of the basis functions, and which uses the features that were derived from 64 msec. frames of signals.

ELE 200153 VILLORENTE, Dennis F. (MS Elec. Eng'g)
Simulation Performance Analysis of New TCP Extensions over Hybrid Satellite Networks. 2001

This thesis investigates the performance of new TCP extensions over hybrid satellite networks using a network simulation setup. Three TCP implementations (TCP Reno, TCP with SACK, and TCP with FACK) incorporating different TCP loss recovery mechanisms are investigated in order to determine which implementations works best over networks that involve the combination of a satellite link with a terrestrial link as well as networks that involve only terrestrial links. Performance analysis is done to determine which among the TCP implementations tested provide the best throughput and efficiency. According to the results of the study, both SACK and FACK perform better than Reno in all environments investigated. Based on these results, it is recommended that SACK be adopted for use on hosts using hybrid satellite networks.

ELE 199854 VIRAY, Frederick (MS Elec. Eng'g)
Reactive Power Management for Voltage Stability if the Luzon Power Grid. 1998

The increasing use of power generation outside the load center of the Luzon Power Grid has created voltage problems for which a solution must be sought. The present operational and practices are focused on the balance of the real power (MW) generation and demand in order to maintain the system frequency. The reactive power (MVAr) generation, however, is not considered to be as important as the MW generation. Although, MVAr generation is being utilized as a solution to any voltage problem which may occur, the practice is more of a reaction to the problem and not a preemptive solution which eliminates voltage problems.

Computer simulations are conducted to study the voltage profile of the grid, using the set up where the source of generation is maximum outside the load center. Simulations show that an outage of generating units or lines, particularly the Extra High Voltage 500kV line(s), can cause system voltage collapse resulting in a system blackout. This can be largely attributed to the low voltage initial profile than the outage of a MVAr source. The low voltage profile is a result of the present practice of the System Operations of not managing MVAr.

The Reactive Power Management (RPM) program which is developed in this paper defines the activities of the different groups involved in the operation of the system. The procedures, operating rules, and strategies are determined with the objective of managing the MVAr. This includes activities to be performed by System Operations Planning to the Reactive Power Dispatch and Control. An information tool is also developed to support the MVAr dispatching activity. This tool includes the capability curves of the different generating units with their corresponding limits (i.e. current and temperatures). A list of existing compensators, substation with On-Load Tap Changers, and a summary of the effect of changing the MVAr at specific nodes is also an added feature in this tool.

Utilizing the developed RPM program, computer simulations show that the voltage at the different nodes of the system can be maintained within the nominal level. The margins between the operating point to the point of system collapse is significantly increased. A reduction in the system losses is also achieved. The program prevented system collapse

or divergence in the simulation where an outage of generating equipment or transmission line occurs. Its contribution is also verified by comparing the change in voltage with respect to a change in MW load. The Voltage Collapse Proximity Indicator is used to determine where the system is operating with respect to the point of system collapse.