New Graduate Program Approval Request

New Degree: Master of Engineering –

Information Engineering Technology

Submitted by

Department of Engineering
Northern New Mexico College (NNMC)
921 Paseo de Onate
Espanola, NM 87532

Principal Contact:
Andres C. Salazar, PhD
Associate Provost, Research & Graduate Studies

Proposal for approval of a new graduate degree

Master of Engineering Degree in Information Engineering Technology

This proposal has been developed based on the New Mexico Department of Higher Education provisions of 5 NMAC 5.2 that apply to new graduate programs proposed for implementation by a constitutional institution of higher education in the State of New Mexico. The organization of this document as outlined in the table of contents below corresponds to 5 NMAC 5.2.9 - Requirements for Approved Graduate Programs (Appendix H).

Table of Contents

Table of Contents: Appendices

A. Purpose of the Program and Mission of the Proposing Institution.
The proposed program must have a clear purpose that is consistent with the mission of the proposing institution.

(1) Primary Purpose

The purpose of this proposal is to initiate in the State of New Mexico a post-bachelor's *professional* education in Information Engineering Technology. The M.Eng. degree, in contrast to the research-oriented M.S. degree, is a professional degree program, meant to extend the education received at the undergraduate level for practicing engineers.

(2) Program Consistency with the Role and Scope of Northern New Mexico College

Providing proper *professional* education is one of the key missions of Northern New Mexico College (NNMC). To quote the Mission statement in the NNMC catalog, "The University develops and offers comprehensive educational programs at the undergraduate, graduate and *professional levels."* Strong professional education in engineering is also very critical for economic development in the state.

(3) Institutional Priority for the Proposed Program

Northern New Mexico College is known for its programs dedicated to the sustainability of the culture, arts, sciences and economic viability of the North Central region of the state. The computer and associated applications involving computer networks, software, administration and databases have become ubiquitous in the commercial, industrial and consumer environment in Northern New Mexico as it has in the rest of the world. The economy that we live in today has become one consisting of transactions of knowledge in its various forms. The assets of business are now knowledge-centric emphasizing its transmission, processing and storage. The education, training and skill enhancement required for a workforce charged with the design, installation and maintenance of the computerized infrastructure can only be accomplished with a college education with a core engineering component with specialized courses in computer and software technology. NNMC began a Bachelor's program in information technology several years ago and it has fast become one of the most popular programs in the college. The program being proposed here simply extends the program to a higher professional level, namely that of the Master of Engineering.

(4) Curriculum & Degree Requirements
a) Program of Study

The academic requirements of the M. Eng. degree in Information Engineering Technology consist mostly of coursework that is interdisciplinary in nature but whose core is still information technology with software engineering, project management and computer design complementing the main area of study.

(b) Coursework:

(1) Upon admission to the program all coursework beyond the six required courses listed below must be pre-approved by the student's academic advisor.
(2) No more than six hours can be taken as a graduate student before being admitted to the program.

(3) No more than 6 graduate hours taken after completion of a baccalaureate degree can be transferred from another institution towards the program requirements.
(4) Except in the case of approved dual degree programs, hours applied towards a Baccalaureate or another Master's program at NNMC or at another institution cannot be applied towards this program.
(5) Courses dual listed as 4XX/5XX and completed with grade B- or better as an undergraduate cannot be taken for credit as a graduate student. If the course is a required course in the program, an elective can be used to fulfill the hours requirement.
(6) Courses completed at NNMC or at another institution with a grade below B- cannot be applied towards fulfilling the program requirements.

Below is a summary of the M. Eng degree requirements for the proposed degree:
Required Courses: (18 hours)

IT510	**Information Assurance and Security**.
IT530	**Network Administration**
EECE547	**Routing and Switching**
EECE 540	**Computer Architecture**
EECE550	**Advanced Data Organization & Structures**
ENGR578	**Engineering Ethics**.

Other Requirements:

(1) A minimum of thirty-three semester hours total (no more than 3 hours of IT599 Topics course);
(3) A maximum of 9 hours at 400 level and a minimum of 24 hours at 500 level; All courses at the 400 level or dual-listed at the 400/500 level including non-engineering courses require prior advisement approval;
(4) A minimum overall GPA of 3.0 for graduation;
(5) Satisfactory completion of comprehensive Master's Exam;

Other courses that can be taken towards the M.Eng. in IET degree being proposed are listed in Appendix E.

(c) Master's Exam:
A comprehensive exam, covering the material in the required courses will be administered twice a year, during the months of January and July. A portion of the exam will be written (lasting no more than 2 hours) and a presentation of a project's results will also be graded as part of the exam. The presentation can be given at the conclusion of a course in which a project is assigned. The Master's Exam will be formulated by the instructors of the required courses.

B. Justification for the Program
The proposed program must meet one or more specified needs within the state or region; must not duplicate existing programs unnecessarily or inappropriately; and,

to the extent feasible and appropriate, should benefit from cooperative arrangements with other institutions.

(1) Need.

The proposed program must meet one or more specified needs with the state or region. Clear and convincing evidence must be provided of the reality and extent of such need.

Companies and organizations have relied on computerization of most of their operations for several decades now and it has become apparent that a workforce trained in information technology has become a critical human resource for remaining globally competitive. US business schools have addressed part of the need by offering Management of Information Systems (MIS) programs at both the Bachelor's and Master's levels. While these programs address much of the need for understanding how the computer infrastructure works – mainframes, software, networking – they fall short in training the student on the technology aspects of the various infrastructure components. To address this shortcoming, an engineering program in information technology has been offered at some colleges, including NNMC, in which the training begins with a solid foundation in math (calculus, statistics) and physics (including lab work) and complementing it with technology oriented courses in software design, computer science, computer networks, protocols, and software applications in databases and computer administration. NNMC is the only college in the state that offers an engineering based degree in information technology.

Unfortunately, a problem that has plagued engineering studies for several years is found also in a Bachelor's degree in information technology. Four years is simply not enough time for a student to reach the professional level in information engineering technology so a Master's degree becomes the entry level degree in this field. Again, no college in New Mexico offers a Master's degree in information engineering technology but several offer an MBA with a concentration in MIS.

(2) Duplication

The proposed program must not duplicate existing programs unnecessarily or inappropriately. A proposal for a program similar to one (or more) that already exist within the state must present clear and convincing evidence that need for the program cannot be met by the existing program(s).

At the present time, except for NNMC, there is no higher learning institution in New Mexico that offers a Master's degree in information engineering technology let alone a Bachelor's.

(3) Inter-Institutional Collaboration and Cooperation

To the extent feasible and appropriate, the proposed program should establish collaborative relationships with other programs within New Mexico, so that state investments can be shared and students can benefit from expanded opportunities across institutional boundaries.

NNMC is in the process of instituting academic collaborative agreements on this program with the UNM Department of Computer & Electrical Engineering, UNM Department of Computer Science and NMT. The agreements will foster (a) mutual acceptance of coursework in Information Engineering Technology and Engineering Management

through distance learning methods; (b) joint research proposals submitted to the Department of Education and the National Science Foundation.

C. Clientele and Projected Enrollment
The proposal must clearly describe the population of students who will be recruited into the proposed program and must include a detailed projection of enrollment and credit hours anticipated during the first five years.

(1) Clientele
It is expected that the prospective clientele for the M.Eng. in IET program are B.S. or B.Eng. graduates of information technology programs from NNMC and out-of-state schools who wish to extend their 4-year education so as to be better prepared for practice in industry. Since few US institutions of higher learning offer Master's programs in information technology, it is expected that the proposed program will attract students from all over the country and possibly from other countries whose educational systems have failed to address the need for the study of information technology at this level.

(a) Application Deadlines
The deadline for admission to the proposed program for the academic year 2010-2011 will be July 1, 2010 and June 1 thereafter. It is anticipated that concurrence from the Higher Education Department and from the Higher Learning Commission will be received by July 1, 2010 for the first year of the program's offering.

(b) Admission Requirements
Graduates from an NNMC's Bachelor's program in any engineering field with an overall GPA of 3.0 are admitted into the Master's program. The requirement for admission into the proposed program from other schools is to have an ABET accredited Bachelor's degree in an engineering field or Engineering Technology with an overall GPA of 3.0. However, baccalaureate graduates in other fields such as math, a physical science such as physics or chemistry will be accepted on a provisional basis with a stipulation that one or more undergraduate courses may be required and must be taken concurrently with any graduate course. Specifically, applicants with non- engineering undergraduate programs will be expected to have taken courses that meet minimal ABET *Basic-Level* requirements, e.g. one year of mathematics and sciences, one-half year of humanities and social sciences, and one and one-half years of engineering topics with at least 12 semester hours of 300-level or 400-level (junior and senior level) course work in an engineering field.
In addition, applicants from other schools should show evidence that they have passed the *Fundamentals of Engineering (FE)* professional engineering examination, or obtain scores of 400 on the GRE Verbal and 650 on the GRE Quantitative and (for those whose native language is not English) have obtained a score of 213 (computer based) or 550 (paper based) or higher in TOEFL exam.

(2) Projected Enrollment
It is estimated that approximately 50% of domestic students will be part-time students, due to their employment at local engineering firms in the Espanola Valley and Santa Fe and at Los Alamos National Laboratory. The projected student enrollment in the

proposed program is given in Table 1. The jump in Year 3 of over 100% is due to the availability of NNMC dormitories that will come online in that year for students whose homes are outside the Northern New Mexico serving area (including foreign students). NNMC has experienced over 70% enrollment by Hispanic students and about 9% Native American students with women forming about 60% of the student body. Similar percentages are expected in the proposed graduate program, at least to start, with the percentage changing over time as more out-of-area students (including foreign) enroll in the program. These percentages will also change as more graduate courses become offered online.

Table 1 Projected Student Enrollment					
Year	1	2	3	4	5
New Students, Part-time	8	8	10	12	15
Returning Students, Part-time	0	5	11	20	28
New Students Full-time	3	4	4	5	6
Returning Students, Full-time	0	3	4	4	5
Total Headcount – 1st Semester	11	20	29	41	54
Graduates – Full-time	0	3	4	4	5
Graduates - Part-time	0	0	0	5	6
Graduates - Total	0	3	4	9	11

It is assumed that full-time students will take 24 credit-hours per year and part-time students will take 12 student credit-hours (SCH) per year. This translates into the student-credit-hours estimated below in Table 2 with the I&G revenue of $1364.98 (Tier 3) for each graduate SCH unit.

Expected Student-Credit-Hours

Table 2 Projected Student Credit Hours (SCH)					
Year	1	2	3	4	5
Total Full –Time Students	3	7	8	9	11
Total SCH – Full Time	72	168	192	216	264
Total Part-Time Students	8	13	21	32	43
Total SCH Part-time	96	156	252	384	516
Total SCH	168	324	444	600	780
Total I&G at Tier 3 Formula	$229,317	$442,254	$606,051	$818,988	$1,064,684

D. Institutional Readiness for the Program
The institution should have nearly all the resources needed to initiate the program. The proposal should include a clear statement of the extent to which the institution is ready to initiate the program, citing the remaining needs and recognized each of those needs in the cost analysis developed.

Because of existing bachelor's degrees in information technology, mechanical engineering and software engineering and other programs in math and science Northern New Mexico College is well prepared to start an M.Eng. degree program in IET. Also due to the institution's location in a technology intensive area of Santa Fe/Los Alamos/Espanola Valley with many local industries and a national government laboratory, excellent practicing engineers are available to teach design-oriented courses as adjunct faculty.

(1) Teaching Faculty
The Engineering department currently has 5 permanent faculty members, three of whom have either substantial industrial experience or relevant research experience. Typically, the department employs about 7 adjunct professors each semester, most of whom have strong engineering practice-oriented experience.

(2) Library and Other Academic Support Resources
Due to existing support for B.Eng. programs in information technology, mechanical engineering and software engineering and other science and technology fields, support is in place for library resources and other academic activities.

(3) Physical Facilities
Again, because of the existing degree programs in information technology, mechanical engineering and software engineering (bachelor and associate degree level), most of the required laboratories and office spaces are in place. The department currently has laboratories for design projects in most of the areas of IT and CS specialization.

(4) Equipment and Technological Resources
Existing equipment and technological resources, e.g. computers and instrumentation, should be sufficient for this new program.

(5) Other or External Resources Required
No other resources, whether internal or external, are required to implement the proposed program.

E. Projected Costs of the Program
The program must include a clear analysis of the project cost of the proposed program and the sources of funding that will support it.

(1) New Cost for Program for Program Startup
Budget: The five year budget is shown in Table 3. The first year shown is for 2009-10, the first year of operation of the proposed program combined with current B.Eng. and A.Eng. programs in the College of Engineering. Start up expenses that include only direct costs total $92K plus $225K for the first two years. These can be absorbed with projections for I&G revenue for current programs if no additional overhead is assumed.

This is a plausible assumption if no additional equipment, classrooms, utilities, services are assumed for the small number of students served during the first two years. SCH funding for 2008-9 at Tier 3 Graduate level was assumed for the computations.

Table 3 Five Year Budget – Direct Expenses & OH ($000)					
Year	1	2	3	4	5
Total I&G at Tier 3 Formula	$229	$442	$606	$819	$1,065
Total SCH	168	324	444	600	780
Full time Faculty Labor Costs ($0.5K/SCH) @80%; Class of 8	$67	$130	$178	$240	$312
Part time Faculty Labor Costs ($0.125K/SCH) @20% Class of 8	$4	$8	$11	$15	$20
Other Expenses at 20% DL	$14	$28	$38	$51	$66
Total Direct Expense	$71	$138	$189	$255	$332
Overhead (OH) Expense	$144	$276	$379	$513	$667

• *Faculty:* For the first 2-3 years existing faculty should be adequate for the program. If enrollments increase at the projected rates, additional faculty lines will be requested in the third year since the earned I&G revenue will be able to support them.
• *Library:* No additional costs for the first five years.
• *Facilities, Equipment, Technological Resources:* No additional costs for the first five years.
• *Teaching or Research Assistants (TAs or RAs):* No additional costs for the first two years. If projected enrollments are realized, additional assistants will be required. State support for hiring TAs or RAs would help in stabilizing the enrollment in the program.
• *Administrative:* After the second year, if enrollment projections are correct, a 0.25 FTE work-study support would be required.
• *Laboratory Director.* The current Laboratory Director position being filled by one of the faculty members is expected to handle any additional work load.
• *Supplies and Expenses:* Flyers and forms will be required to start up the program at an estimated cost of $3,000 for the first year, a budget item included in the projected budgets.

(2) **State Support:** In Table 2 the student credit-hour estimates are used to estimate I&G revenue for the first five years. Grants currently supporting academic activities in the College of Engineering are excluded since they are term limited and cannot be assumed to persist after their designated terms.
(3) **Other Support:** No specific support from other sources is identified at this time. However, it is expected that some support will be forthcoming from research contracts and/or training grants from industry, before the end of year-three. None of this research funding is assumed in the

budget forecast. In addition, an application has been submitted for a US Dept. of Education Title V grant for graduate programs.

F. Quality of the Program
(1) Assessment Procedures

The program will comply with Higher Learning Commission (HLC) accreditation standards and AQIP process monitoring that has been in place at Northern New Mexico College for three years. *Weave-Online* is the computer based assessment tool that has been used during the prior two academic years to archive assessment data on selected academic programs including those from the College of Engineering.

Since ABET accredits only one professional degree in an engineering department, the B.Eng. degree in IET will remain the accredited degree when granted. NNMC will apply for ABET accreditation in Fall 2009 for its Bachelor's programs. The M.Eng. program is essentially structured to meet ABET accreditation standards such as complying with Outcomes A-K and continuous improvement methodology. Graduate courses from the M.Eng. program will be subject to periodic assessment procedures in the same way that current undergraduate engineering programs are being monitored for consistency, learning achievement and continuous improvement.

(2) Quality Assurance Measures

Metrics being used for undergraduate engineering programs as quality assurance measures of student learning include project reports, quizzes, homework, exams, and class presentations. These metrics will be used to assure consistency in quality of the M.Eng. program.

G. Assessment of Operations and Impact
The proposal must include a plan by which the proposed program will be assessed for its operation and impact over at least a five year period.

(1) Monitoring Methodology

The operation and impact of the program will be monitored at both the Office of Graduate Studies, departmental levels and by an engineering advisory committee whose members are from industry or governmental laboratories. An exit questionnaire will be required of all graduating students. Industrial and alumni surveys will be taken to assess the impact of the program. This proposal will also be submitted to the HLC for review and approval. Upon obtaining approval the program will undergo the same monitoring and assessment process of existing programs that have been accredited by HLC. The engineering programs at the Bachelor's level will remain the programs that will be accredited by ABET, such accreditation expected before Fall 2010.

(2) Evaluation from Stakeholders

The results from exit questionnaires and the annual evaluation of the program by the engineering advisory committee will be used for updating the curriculum, adjusting the project requirements, improving the teaching methodology and monitoring the admission standards. Surveys will be sent to current and prospective employers of the program graduates and the associated feedback will also be used to evaluate the relevance, quality and academic focus of the program.

H. Administrative Responsibility for the Program and Institutional Commitment.

There must be clear indication in the proposal that the institution is committed to the success of the proposed program.

(1) Departmental Responsibility

The Department of Engineering is responsible for implementing and administering the program. The departmental faculty and administrative staff is deemed adequate in education, training, experience and educational and research commitment for supporting the proposed program. Each departmental full-time faculty member has undergone training in the teaching of science and math, has completed orientation in college and departmental advisement, has familiarized him/herself in the program curriculum and has been assigned to teach one or more of the graduate courses in the program.

(2) Administrative Support

The NNMC Administration with the support of the Board of Regents has continued support for the current IET Bachelor's program and has approved the program described within as complementary and necessary to the professional training of IT engineers. Academic support in the form of library facilities, research laboratories, classroom and lab equipment for teaching is in place to assist the instructional staff in the program. Student services such as scholarship availability, program advisement, TA and RA availability are in place to support student success in the program.

Additional funding for TA and RA positions has been requested through a RPSP submission to the January 2010 NM Legislature in the amount of $300 thousand for both engineering and teacher education Master's programs anticipated to start in Fall 2010. In addition a $2.5 million Title V (graduate) grant has been requested from the US Department of Education for administrative and academic support of the same engineering and teacher education programs.

Appendix A: Approvals Received

Approving Body	Date Presented	Date Approved	Comments
Engineering Dept	10/2/2008	10/2/2008	
NNMC Library	10/2/2008	10/2/2008	
NNMC Ad Hoc Graduate Committee	10/2/2008	10/2/2008	
NNMC Academic Dean's Council	Does not apply	Does not apply	
NNMC Faculty Senate	7/17/2008	7/17/2009	
Registrar	7/17/2009	7/17/2009	
NNMC Provost	10/3/2008	7/17/2008	
NNMC President	10/3/2008	7/17/2008	
NNMC Board of Regents	7/27/2009	7/27/2009	
New Mexico Council of Graduate Deans			
Academic Council of Graduate Deans			
Academic Council for Higher Education			
NM Dept. of Higher Education			
NM State Board of Finance			

Appendix B Letters of Support

October 7, 2008

Professor Andres Salazar
Ph.D., Vice Provost
Northern New Mexico College
921 Paseo De Onate
Espanola, NM, 87532
505-747-2266

Reference: Letter of Support for M. Eng. In IET

Dear Dr. Salazar:

I strongly endorse the request from the School of Engineering at the Northern New Mexico College (NNMC) to start a graduate program in Information Engineering Technology (IET). There is a high demand for educated students at this level. I believe the NNMC School of Engineering has highly qualified full-time faculty members that have doctoral education and comprehensive research experience in several areas of expertise, in particular, Computer Engineering, Computer Programming, Software Engineering, Networking and Control Engineering. NNMC has had students enrolled in its Bachelor of Science in Information Technology (BSIT) for several years and its graduates will be ready for graduate studies in IET next year, so the timing of the Master's program inaugural is important.

I am also particularly interested in future collaboration between NNMC and Auburn University. For example, research collaboration between the two schools in parallel and distributed computing can lead to innovations in several fields of information technology.

If you have any further questions, please feel free to contact me.

Sincerely,

Kai H. Chang
Alumni Professor and Chair
changka@auburn.edu
334-844-6310

HOWARD
UNIVERSITY

College of Engineering, Architecture
and Computer Sciences
Department of Electrical and Computer Engineering

October 6, 2008

Please accept this letter in support of the graduate program in Information Engineering Technology that is being considered at Northern New Mexico College. This field has been in need of appropriate graduate programs to train engineers at the Master's level. The growth of computer networks and the associated need for securing those networks have led to a shortage of administrators, planners and designers who can assure that the networks provide the reliable uptime for companies and individual users alike. Furthermore, since NNMC has already a well established Bachelor of Science in Information Technology (BSIT) program, the natural next step is to provide a graduate program available for these graduates. I also believe the proposed program will be attractive to graduates from other universities, who will find the Master's program at Northern New Mexico College attractive for furthering their career. I am very excited that such a program will be available and I am confident that NNMC faculty will deliver a first rate instruction.

If you have any further questions, please feel free to contact me at 202-806-4816 and/or by email: mchouikha@howard.edu

Sincerely,

M.F.Chouikha, Ph.D.
Professor and Chair
Department of Electrical and Computer Engineering
Howard University

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Washington, DC 20059

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Facsimile 202 806 5258
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CITY OF ESPAÑOLA

2008-35

A RESOLUTION IN SUPPORT OF THE CREATION OF MASTERS DEGREES PROGRAMS AT NORTHERN NEW MEXICO COLLEGE.

WHEREAS, Northern New Mexico College is an asset to the citizens of the City of Espanola and Northern New Mexico, and

WHEREAS, The City of Espanola benefits from the location and growth of Northern New Mexico College, and

WHEREAS, further development of the programs at Northern New Mexico College, impact the City, surrounding communities, businesses, and citizens in a positive manner, and

WHEREAS, Northern New Mexico College, under the leadership of a progressive Board of Regents, sound administration, and a strong faculty have propelled Northern New Mexico College upward, and
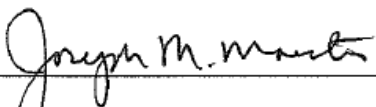
WHEREAS, Northern New Mexico College is now seeking to implement Masters Degrees Programs to further the education of its student body and encourage new applicants to become part of Northern New Mexico College, and

WHEREAS, the City of Espanola and its Citizens will benefit from increased activity and educational levels associated with Masters Degrees Programs at Northern New Mexico College.

NOW, THEREFORE, BE IT RESOLVED by the Governing Body of the City of Española does hereby support the efforts of Northern New Mexico College in the creation of Masters Degrees Programs at Northern New Mexico College.

PASSED, APPROVED AND ADOPTED, this 25th day of November 2008.

Attest:

Joseph M. Maestas, Mayor

Lucas Gauthier, City Clerk

Approved as to form:

Appendix C
Qualifications of Engineering Faculty Members Associated with Program

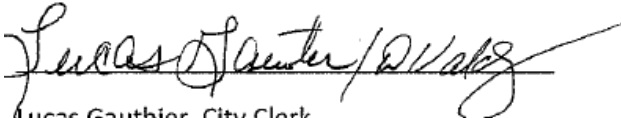| Name	Title	Experience	Areas of Research	Courses Taught
A. Salazar, PhD – Michigan State University	Assoc. Provost	34 years industry – Bell Labs (18); small firms (16); College (5)	Communications; Software Engr; Engr. Management	CS570 Software Quality Assurance EECE541 Intro. To Comm. Systems ENGR470-479 Engineering Management Series
I. Lopez, PhD University of New Mexico	Chair, Engr. Dept	4 years industry – Schlumberger; college (3)	Control; Mechatronics; Software Control;	ME574 Modeling, Simulation & Synthesis of Electro-Mech. Control EECE541 Intro to Comm. Systems.
J. Crichigno, PhD University of New Mexico	Asst. Prof.	6 years research – UNM Comp. Engr. Dept	Communications, Software, Comp. Engr.	CS560 Software Engineering
F. Shi; PhD University of Toledo	Asst. Prof.	5 years research – various colleges	Control Systems	ME574 Modeling, Simulation & Synthesis of Electro-Mech. Control
F. Shen, PhD Auburn University	Asst. Prof	4 years industry	Parallel Computing; Software engr.	IT530 Network Admin; CS570 Software Quality Assurance CS541 Data Organization
P. Medvick; PhD Univ. of Hawaii	Adjunct	20+ years research lab.	Software; Project Management	ENGR574 Project Management CS551 Design of Large Programs
E. Wiswell, PhD Purdue Univ.	Adjunct	20+ years industry – TRW (18)	Communications; Control; Wireless Systems;	EECE541 Intro to Comm. Systems

Andres C. Salazar, PhD

Interim Exec. VP, Finance & Admin.*(2009-present),* **Associate Provost – Research & Graduate Studies,** *(2008-present);* **Dean, College of Engineering** *(2008-9),* **Chair – Computer & Engineering Technology Dept,** *2007-8.*
Research Professor, School of Engineering, *University of New Mexico, 2007-present.*
Former Professor & PNM Chair in Microsystems, Commercialization and Technology;
University of New Mexico: School of Engineering, UNM Anderson Schools of Management, 2002-7;
Degrees with fields, institution, and date:
  MBA, Bus. Admin. **Heriot-Watt University, Edinburgh, U.K**. 1998 (Edinburgh Bus. School)
  Ph.D,. Elect. Engineering **Michigan State University** 1967 (NSF Graduate Scholarship)
  MSEE, Elect. Engineering **University of New Mexico** 1965 (NSF Graduate Scholarship)
  BSEE, Elect. Engineering **University of New Mexico (with Distinction)** 1964
  BA, Math (English minor) **University of New Mexico (with Distinction)** 1964
Industrial Experience *(34 yrs total, 22 yrs management, 17 yrs as company officer)*
  1984 – present **Suntek Industries**; Santa Fe, NM. **Founder** of management consulting company. Clients include AT&T Bell Labs, Integrated Network Corp., Mixbaal, S.A. de C. V. (Mexico City); Asurent Wireless, Inc; The Prediction Company
  1994-2002 **Digital Transmission Systems, Inc (DTS)**, Duluth, GA. **CEO** of public holding company with several subsidiaries, all in manufacture or sale of telecom equipment; (2001 sales $50M, 115 emp.)
  1991-1994 **AT&T Paradyne Corp**., Largo, FL. **VP, CTO of Corporation**, a manufacturer of datacom and telecom equipment. (1994 Sales $500M, 2200 emp.)
  1989-1991 **TyLink Corp**., Norwood, MA. **Sr.VP Operations, Engineering & Service**. Manufacturer of datacom and telecom equipment (1991 Sales $8M, 32 emp.).
  1984-1989 **Infinet, Inc**., North Andover, MA, **VP Engineering**. Manufacturer of telecom equipment (1988 sales $45M, 130 emp.)
  1976-1984 **AT&T Bell Labs**, Holmdel, NJ. , **Specialist**, **Supervisor**, workstations, protocols development.
  1975-1976 **United Nations**; **Telecom ITU Expert**, training in Geneva, Switzerland, assigned *to Secretaria de Comunicaciones y Transportes*, Mexico City. (teaching and consulting duties)
  1967-1975 **AT&T Bell Labs**, Holmdel, NJ. **Member of Technical Staff**, Specialist in communications research and development.

Honors, Scientific and professional societies:
  Senior Member, 1961-*The Institute of Electrical and Electronics Engineers*
  Local Arrangements Chairman - *Seventh Data Communications Symposium,* Mexico City, October 1981, sponsored by IEEE Computer Society and ACM.
  Registration Chairman - *Eighth Data Communications Symposium*, North Falmouth, Massachusetts, October 1983, sponsored by IEEE Computer Society and ACM.
  Chairman, Southeast Region, 1998-1999 *American Electronics Association*
  Distinguished Engineering Alumnus, 2002, School of Engineering, *University of New Mexico*

Summary of Activities at NNMC August 2007-Present
Teaching & Curriculum Development:
- Instructor of courses in NNMC College of Engineering (COEG) (electrical and computer engineering – ECE – and mechanical engineering – ME – and IT – information technology and SMET – STEM orientation course for high school concurrent students) and Department of Business Administration (international business, ethics & business);
- Developed three new Bachelor's degree programs – Information Engineering Technology, Mechanical Engineering with Solar Emphasis, Software Engineering; (Approved by HED and HLC accrediting agencies)
- Developed two new Master's degree programs – Information Engineering Technology, Mechanical Engineering with Solar Emphasis (both under review)

Research:
- Published 4 peer-reviewed *business* journal or conference articles for IABE journals.
- Published 3 monographs on research in solar engineering related topics conducted for UNM/PNM and NNMC

Grants:
- As Co-PI and Director of STEM Programs in COEG received NSF STEP contract award totaling nearly $300K with $200K aggregate extension possible in years 4 and 5.
- Together with NNMC President led the NNMC- wide initiative for the establishment of Solar Energy Research Park and Academy (SERPA) with $3 million grant from 48th NM Legislature.
- In second year inherited MSEIP Grant of $500K over a three year period as Director.

Campus Service & Administration:
- 2007-8 Member of Campus-wide faculty committees on senate formation and tenure.
- Member of Committee on Retention, Assessment, Curriculum, Staff Association;
- Recruited four new faculty members to College of Engineering 2007-8.
- Member of SOE Recruitment Committee for ME Dept Chair and ECE professor in Microsystems (2004).
- As Vice Provost promoted the development of Master's Degree proposals at NNMC, attended NM Council of Deans meetings, advocated and reviewed research proposals from STEM faculty;

Community Service:
- Co-Founder of *High Desert Venture Camp* – An Entrepreneurship Conference for students, faculty and community members, held 2005, 2006, 2007 and 2008.
- Member of regional economic development organizations –Regional Development Corp. (board member – 2002-9);
- Member of NNMC Foundation, non-profit formed to manage and grow endowment.(2008-present), Chair of Fundraising Committee (2009-present)

Student Service:
- Faculty advisor to all students in engineering. (2007-8)
- Faculty advisor to COEG seniors;(2008-9);
- Director, STEM Programs – MSEIP & ASPIRe (2007-present)

Andres C. Salazar, PhD

Summary of Activities at UNM August 2002-August 2007

Teaching:
- Taught 18 courses in UNM School of Engineering (SOE) (electrical and computer engineering – ECE – and mechanical engineering – ME – departments) and Anderson Schools of Management (ASM) over the 10 semester period since being hired at UNM (cumulative over 1,250 student credit hours).
- Taught upper division level ECE and ME courses
- Taught 2 new courses at ASM. (Project/Program Management and Tech Transfer – Asia/USA)
- Spearheaded approval of 3-2 MBA and double master's programs for Electrical and Computer Engineering (ECE) students at both SOE and ASM

Research:
- Published 18 peer-reviewed *business* journal or conference articles for NBES, AGB, USASBE, IABE and Mountain Plains Business Conferences.
- Published 21 peer-reviewed *engineering* journal or conference articles in IEEE or other engineering publications (pre 2002)
- Published 33 industrial monographs for AT&T Bell Telephone Laboratories (pre 2002)

Grants:
- Received 7 contract awards totaling over $200K for the Center on Entrepreneurship and Innovation (CEI) including 2 from the Kauffman Foundation, NCIIA, SATOP and LANL, PNM and Mission Research(AFRL contract).
- Led the UNM- wide initiative for the National Collegiate Entrepreneurship Initiative from Kauffman Foundation (2003), awarded $50K planning grant.

Campus Service:
- Member of Campus-wide faculty committees on "Environment Scanning," "Areas of Marked Distinction," and "Standing Committee on Intellectual Property." (2002-5)
- Member of Prince of Asturias Endowment Committee(2004-);
- Member of ASM Curriculum and Programs Committee (2003-5);
- Member of SOE Recruitment Committee for ME Dept Chair and ECE professor in Microsystems (2004).

Community Service:
- Co-Founder of *High Desert Venture Camp* – An Entrepreneurship Conference for students, faculty and community members, held 2005, 2006.
- Member of regional economic development organizations – NextGen (advisory board 2004-present) and Regional Development Corp. (board member – 2002-present);
- Adjunct staff member of NM State Dept of Economic Development – 2004-5 - Operations Chair of Microsystems/Nanotechnology Partnership (MiNaTeP)

Student Service:
- Faculty advisor to Students for Economic Development Club (2004, 2005);
- Faculty advisor to Collegiate Entrepreneurship Club(2005);

Publications in teaching or research – over 50 total professional peer-reviewed journal or conference papers and over thirty industrial monographs, 1 book, 1 patent.

JOURNAL ARTICLES IN BUSINESS, MANAGEMENT & PUBLIC POLICY

Salazar, Andres C. and Kumar, Girish. (2004) *Business Creation and Commercialization of Technology at a University: In Search of the Holy Grail.* **Review of Business Research**, Vol II, No. 1, pp 76-82.

Salazar, Andres C. (2005) *Modern Strategy and Contract Issues in Technology Between Firms in Licensing of Technology.* **International Journal of Business Research,** Vol. 2, No. 1, pp 145-151**.**

Salazar, Andres C. (2006) *Albuquerque: City of Contrasts*. **Canadian Journal of Regional Science**, Vol XXVIII, No. 2, pp265-281.

Salazar, Andres C. (2006) *Economic Development at a Public University- A Process Model and Associated Metrics*. **Review of Business Research**. Vol VI, No. 4, pp133-142,

Salazar, Andres C. (2006) *The Budget Battleground at a Public University.* **Journal of Applied Business and Economics**, Vol 6, No. 2, pp42-53.

Salazar, Andres C. (2007) *Innovation and National Economic Strategy*. **International Journal of Business Strategy**, Vol. 7, No. 2, pp198-205.

Salazar, Andres C. (2008) *Innovation and Engineering School Ranking*. **Journal of International Business & Economics**, Accepted for publication

Salazar, Andres C. (2009) *Anti-donation Clause – Time to Delete?,* **Review for Business Research,** publication in October 2009.

Salazar, Andres C. (2009) *Seven Deadly Factors Associated with Technology Company Failure,* **European Journal of Management,** publication in October 2009.
.

CONFERENCE PAPERS IN BUSINESS, MANAGEMENT & PUBLIC POLICY

Salazar, Andres C. (2003)*, Supplementing Engineering Education with Business Training.* **Proceedings of Teaching Entrepreneurship to Engineering Students Conference***,* Monterrey, CA, January 12-16, 2003. pp 237-241.

Salazar, Andres C. (2003), *Is Independence an Extinct Virtue on Boards?*, **Albuquerque Journal,** (Business Outlook Supplement, p. 7), January 16, 2003.

Salazar, Andres C. (2003) *Role of the University in MEMS Development,* **Proc. Of First MEMS Conference in Mexico**, Puerto Vallarta, Mexico, October 17-19, 2003. (Talk delivered in Spanish).

Salazar, Andres C. (2004) *In Defense of Economic Development at a Public University.* **Proceedings of Mountain Plains Business Conference**, Grand Junction, CO, October 13, 2004. (electronic proceedings)

Salazar, Andres C. and Kumar, Girish. (2004) *Business Creation and Commercialization of Technology at a University: In Search of the Holy Grail.* **International Academy of Business and Economics Conference**, Las Vegas, NV, October 18, 2004.

Salazar, Andres C. (2004) *Modern Challenges of New Business Creation & Entrepreneurship in Rural Areas;* **Association of Global Business Conference**, Cancun, Mexico, November 18, 2004.

Salazar, Andres C. (2005) *Board Member Selection in New Technology Businesses.* (2005) **Proceedings of USASBE/SBI Conference**, Indian Wells, CA, January 13, 2005. p 61 (abstract).

Salazar, Andres C. (2005) *MiNaTeP in New Mexico – A Micro/Nano Initiative in Economic Development.* **BioMEMS Conference, Monterrey, Mexico,** March 4-5, 2005. (abstract only) (Talk delivered in Spanish).

Salazar, Andres C. (2005) *The Budget Battleground at a Public University.* **National Business and Economics Society Conference,** Key West, FL, March 13, 2005.

Salazar, Andres C. (2005) *Modern Strategy and Contract Issues in Technology Between Firms in Licensing of Technology.***, International Academy of Business and Economics Conference**, Las Vegas, NV, October 18, 2005.

Salazar, Andres C. (2006) *Study of Failure of High Technology Firms Through Near-Death Experience*. Proceedings of **US Association of Small Business and Entrepreneurship Conference**, Tucson, AZ, January 13, 2006.

Salazar, Andres C. (2006) *Poverty and Prosperity in the Rocky Mountain States- A Parametric and Statistical Analysis.* Proceedings of the **National Business and Economics Society Conference**, Los Cabos, Mexico, March 10, 2006.

Salazar, Andres C. (2006) *Economic Development at a Public University – A Process Model and Associated Metrics*. **International Academy of Business and Economics Conference**, Las Vegas, NV, October 18, 2006.

Salazar, Andres C. (2007) *Opportunities for Rural Economic Development,* **International Business and Finance Research Conference,** South Padre Island, TX, January 4-6. 2007.

GRADUATE THESIS ADVISEMENT IN ENGINEERING

Pasos, Rudolfo, Maestria de Ingenieria, Centro de Investigacion y Estudios Avanzados, *Instituto Politecnico de Mexico,* 1976

Bobadilla, Roberto, Maestria de Ingenieria, Centro de Investigacion y Estudios Avanzados, *Instituto Politecnico de Mexico*, 1976

JOURNAL ARTICLES IN ENGINEERING

Brophy, F. & Salazar, A. (1973) *Considerations of the Pade Approximant Technique in the Synthesis of Recursive Digital Filters*, **IEEE Trans. on Audio and Electroacoustics**, Dec. 1973.

Foschini, G., Smith, J & Salazar, A. (1974) A. *Markov Process Analysis of PCM Line Monitors*, **IEEE Trans. on Communications,** Feb. 1974.

Brophy, F. & Salazar, A. (1974)*Recursive Digital Filter Sysnthesis in the Time Domain*, **IEEE Trans. on Audio and Electroacoustics**, Feb. 1974.

Salazar, A. (1974) *Design of Transmitter and Receiver Filters for Decision Feedback Equalization*, **Bell System Technical Journal,** Mar. 1974.

Foschini, F. & Salazar, A. (1975) *Data Pulse Design - Realizability Considerations***, Journal of the Institute of Mathematics and Its Applications**, April 1975.

Brophy, F. & Salazar, A. (1975) *Synthesis of Spectrum Shaping Digital Filters of Recursive Design*, **IEEE Trans. on Circuits and Systems**, Mar. 1975.

Brophy, F. & Salazar, A. (1975) *Two Design Techniques for Digital Phase Networks*, **Bell System Technical Journal**, April 1975.

Guthery, S. & Salazar, A. (1975) *Statistical Methods for Determining Quality of Communication Channels*, **IEEE Trans. on Communications**, Jun. 1975.

Lawrence, V. & Salazar, A. (1980) *Finite Precision Design of Linear Phase FIR Filters,* **Bell System Technical Journal**, 59:1575-1598, No. 9, November 1980.

Salazar, A., Scarfo, P. & Horn, R. (1987) *Network Management Systems for Data Communications*, **IEEE Communications Magazine**, August 1987.

BOOK:
Digital Signal Computers and Processors, (Salazar, A., editor), an **IEEE Press Book**, 1977c.

CONFERENCE TALKS IN ENGINEERING

Foschini, G., Smith, J. & Salazar, A. (1973) *Markov Process Analysis of PCM Line Monitors*, **International Conference on Communications, Seattle, WA**., June 11, 1973.

Brophy, F. & Salazar, A. (1973) *Recursive Digital Filter Synthesis in the Time Domain*, **Nat'l Telecom Conference, Atlanta, GA.**, November 28, 1973.

Brophy, F. & Salazar, A. (1973) *Synthesis of Sprectrum Shaping Digital Filters of Recursive Design*, **Arden House Symposium on Digital Filtering**, Harriman, NY, Jan. 14, 1974.

Foschini, F. & Salazar, A. (1974) *Data Pulse Shaping Networks*, **International Symposium on Circuits and Systems**, San Franscisco, CA, April 25, 1974.

Guthery, S. & Salazar, A. (1974) *Statistical Methods for Determining Quality of Communcation Channels*, **Nat'l Telecom Conference**, San Diego, CA, April 25, 1974.

Brophy, F. & Salazar, A. (1974) *Two Design Techniques for Digital Phase Networks*, **Nat'l Telecom Conference**, San Diego, CA, Dec. 2, 1974.

Salazar, A., Sherman, D., Verma, S. & Werner, J. (1974) *Implementation of Voiceband Modems on a Digital Signal Processor*, **Nat'l Telecom Conference**, New Orleans, LA, Dec. 1975.

Salazar, A. (1978) *System Planning for Digital Signal Processors*, **National Electronics Conference**, Chicago, IL, Oct. 1978.

Salazar, A. (1979) *Effects of Finite Coefficient Precision on FIR Filter Spectra*, **Int'l Conf. on Acoustics, Speech and Signal Processing**, Washington, DC, April 1979.

Lawrence, V. & Salazar, A. (1980) *Design of FIR Filters with Finite Coefficient Precision*, **International Conference on Communications**, Paris, France, April 1980

Lawrence, V. & Salazar, A. (1982) *Design and Implementation of Transmitter and Receiver Filters with Periodic Coefficient Nulls for Digital Systems*, **International Conference on Acoustics, Speech and Signal Processing**, Paris, France, May 1982.

Salazar, A. (1997) *Managing and Deploying High Speed Connections in PCS Networks*, **Communications Networks Conference**, Vancouver, B.C., June 1997.

INDUSTRIAL MONOGRAPHS IN ENGINEERING

Fujimoto, Toshi, Antoun, Nicolas and Salazar, Andres C., *Vehicle Battery Technology – Players, Trends and Effects on PHEV Development and the Power Grid*, a Research Report sponsored by PNM Resources under contract with University of New Mexico, January 2006.

Salazar, Andres C., *Energy Storage Technology Roadmap & Solar PV Analysis – A Study Conducted for PNM Resources Under a Research Contract with University of New Mexico*, January 21, 2008.

INDUSTRIAL EXPERIENCE

Feb. 2002 to present **SUNTEK INDUSTRIES, INC**., Santa Fe, NM;

President

- Business consultant to corporate strategy, operations planning, market assessment, organizational structure and mergers and acquisitions.
- Clients served include *AT&T Bell Laboratories*, *AT&T Paradyne*, *Integrated Network Corporation, Asurent Wireless*, *Mixbaal, and Prediction Company.*

1994 to Jan 2002 **DIGITAL TRANSMISSION SYSTEMS, INC.,** a public company (DTSX: NASDAQ then OTC), Duluth, GA; FY2001 rev. $48M; **Chief Executive Officer**.

- Responsible for strategy and business concept first developed in 1994 of designing and marketing T1/E1 network access and sub-aggregate wireless transport products that address growing cellular and PCS markets domestically.
- Led financing of the development of spread spectrum radio products for telecom applications sold worldwide in over 40 countries.
- Rebuilt management team including marketing and sales, re-engineered corporate structure with new ERP system for finance, manufacturing, and instituted quality programs with ISO 9001 certification in December 1994.
- Led micro-cap IPO with NASDAQ listing by NYC investment banker firm. Road show included stops in New York City, Boston, San Francisco and Orange County.
- Headed up M&A and investment activity (8 transactions in 8 yrs); acted as company liaison officer to investors, analysts and shareholders.
- Submitted annual business plans and monthly operations reports to investor-led Board; since 1996 edited all 10K, 10Q, proxy SEC filings.
- Company honored with "Georgia Top 100" Award in 2000 for public companies by Atlanta Journal-Constitution, the city's major newspaper.
- For a major investor, Wi-LAN, Inc., started up US based subsidiary, Wi-LAN Wireless Data Communications, Inc.,(WWDC) focused on intellectual property development in OFDM technology. As President of WWDC, acted as liaison to Yamacraw economic development program in Georgia.

1999-2000 **MICROTEL**, Ontario, CA FY1999 rev $40M (duties concurrent with DTS employment)

Group Vice President

- For major investor in DTS, responsible for strategic management of 3 telecom subsidiaries of Microtel, a public holding company of seven subsidiaries.
- Supervised the management restructuring of a Silicon Valley telecom equipment subsidiary.
- Headed up Strategic Planning for Microtel during 1999 year.

1991-1994 **AT&T PARADYNE**,(ATTP) Largo, FL; FY1993 rev. $425M (subsidiary of AT&T), **Vice President & Chief Technical Officer**

- As Business Unit General Manager, responsible for $150M business of digital modems (DDS), multiplexers, analog modems and routers. Restructured 50 member marketing and 400 member engineering departments in first six months.

- Headed up product marketing, product management and marketing research groups of company's major product lines of proprietary design – DDS, Analog modems, multiplexors and network access devices.
- Negotiated OEM contracts with *Ascend* and *Premisys*, including equity stake in latter company for re-sale of networking gear and third generation access devices.
- Initiated development of "Spinnaker" and "Geneva" product lines in network access and two-wire full duplex private line modems, projects based on approved business plans.
- Oversaw and was responsible for Bell Labs development in ADSL, ATM network switching and high-speed modem chip technology for ATTP.
- As CTO of corporation, responsible for corporate technology planning and strategy and was liaison to *AT&T* Intellectual Property Department and participated in *AT&T* Strategic Planning in Technology. As CTO, represented *AT&T Paradyne* in *AT&T Bell Laboratories Technical Officers Forum.*

1989-1991.   **AVANTI COMMUNICATIONS CORP**. (later known as TyLink), Norwood, MA, FY1991 rev. $8M;
Senior VP, Operations.

- Managed hardware and UNIX/C software development of T1 products - networking and point to point multiplexers, T1 access products and high speed line drivers.
- Supervised company's factory operations in 20,000 square feet facility consisting of fully automated assembly and test, materials management and quality control.
- Responsible for full customer service profit and loss operation including systems servicing of installation, T&M and term contracts with featured 24 x 7 availability.
- Responsible for relocating company operations, including manufacturing, from Norwood, MA and Newport, RI to Norton, MA in 1991.

1984-1988.   **INFINET, INC**, Memotec Group division (Canada), N. Andover, MA, 1988 rev. $40M; **VP, Engineering**

- Led the design and development of new major revenue producing modem product line that played a critical role in attracting new investment and leading the company from a loss of $14M in 1985 to a PBT of 11% at a revenue level of over $40M in 1987.
- Introduced UNIX/C for engineering development platform, change control system for software development, VLSI chip development of major modem modules, and DSP chip usage from TI and Analog Devices for equalizer implementation.
- Responsible for the technology acquisition of performance measurement product line from subsidiary in Herndon, VA.
- Formed a software consulting business unit with over $2M of awarded contracts in less than a year from Teleglobe, a long distance telephone utility also owned by Memotec.

1967-74   **BELL LABS and AT&T INFORMATION SYSTEMS**, Holmdel, NJ
1976-83   **Research Specialist, Technical Manager**

- 1982-84 Technical Manager - Unix PC/ Workstation, Communications and graphics software. Led 22 engineer team in development of GUI interface and X.25 network layer protocol for personal workstation to PBX system.
- 1980-82 Technical Manager - PBX Applications Software/communications. Led 15 engineer team in design and deployment of X.25 link and network layer protocol in adjunct minicomputer to PBX system.

- 1976-80 Specialist in Network Control and Management – Conducted research in: modem network protocols, effects of finite precision digital filters in signal design; wrote UNIX/C software for system testing and tape generation of Network Controller of DataPhone II system.
- 1967-74 Specialist in Data Transmission & Speech – Conducted research in: Speech analysis and in the processing of speech and data signals, design of recursive and nonrecursive digital filters, equalization algorithms, timing and phase recovery methods, signal shaping and high speed digital signal processor architectures.
- 1972-1983 PhD Recruiter for Bell Labs in New Mexico – Recruited six PhD graduates from University of New Mexico and New Mexico State to Bell Labs.

1975-6 **UNITED NATIONS, INTERNATIONAL TELECOMMUNICATIONS UNION** – (ITU) - Geneva, Switzerland; assigned in Mexico City as Digital Communications **Expert.**

- Trained in Geneva, Switzerland to be digital communications consultant to Secretariat of Communications and Transport of Mexico.
- Trained government engineers in digital communications, wrote associated course book in Spanish, taught at local universities. Subject matter expertise included T-Carrier equipment design, digital data network planning, digital signal processing.
- Assisted in the design of a microwave network for Mexico.

Ivan Lopez-Hurtado, PhD
Assistant Professor, Chair, Engr. Dept.
Northern New Mexico College

Education

PhD in Electrical & Computer Engineering (Control Systems), August 2008
University of New Mexico, Albuquerque, NM, USA.   GPA: 4.2/4.3

 Dissertation*: Limitations of Networked Controlled Systems.*

Master of Science with a Major in Automation (Control Engineering), June 1998
Instituto Tecnologico y de Estudios Superiores de Monterrey, Campus Monterrey.
Monterrey, Nuevo Leon, Mexico.   GPA 96/100

Thesis*: Design of Auto Tuning PID Controllers by means of Genetic Programming*
Summa Cum Laude (Mención Honorífica de Excelencia).

Bachelor of Industrial Physics Engineering, December 1995
Instituto Tecnologico y de Estudios Superiores de Monterrey, Campus Monterrey.

Monterrey, Nuevo Leon, Mexico.   GPA 98/100
Summa Cum Laude (Mención Honorífica de Excelencia).

Skills

Languages: Spanish Native Speaker.
Software: Labview, LabWindows, Matlab, Maple, Unix, basic programming in
VHDL, C and Visual Basic.

Experience

Graduate Assistant, UNM-ECE Department   August 2004 – July 2008
University of New Mexico   Albuquerque, NM, USA

- Consultant for NASA-Space Alliance Technology Outreach Program (SATOP) Projects:
      Example: A) Rechargeable battery circuit design (LaserLure),
      B) microcontroller and sensor selection for dryer (Hydromatic Technologies Corporation),
      C) Eddie current inspection on a tank (Entergy),
      D) Specifications design for a voice recognition system in a toy,
      E) Electronic design of a physiological measurement system, etc.
- Research experience in networked control systems and tele-operation.

- T.A. for the courses Logic Design, VHDL Lab, Control Systems and Stochastic Systems.

Internship (User Interface Development)   *September 2006 – December 2006*
<u>K&A Wireless</u>   Albuquerque, NM, USA
- Design and implementation of a prototype/final product of a heart rate sensing system with Bluetooth communication with a mobile phone including a PC interface in Labview.

Chairperson, Mechatronics Engineering Faculty   **May 2002 – August 2004**
<u>Tec de Monterrey, Campus Juarez</u>   Cd. Juarez, Chihuahua, Mexico.
- Quality assurance of faculty, adjunct professor, labs, curriculum, etc.
- Planning and directing of faculty and student activities (up to 200 students in the program).
- Promotion and recruiting activities of the mechatronics undergraduate program.
- Problem-Based Learning certified instructor.
- Professor of Control Systems, Logic Systems, Math and Dynamics (since August 2001).

Project Engineer   **March 2001 – May 2002**
<u>VI Technology</u>   Cd. Juarez, Chihuahua, Mexico.
- Systems Integration based on Labview/CVI programming and National Instruments hardware.
- Testing System Design (NI hardware/ Labview Software) for the following products:
    - Telescopic Actuator (Valeo), including force/current/speed measurements.
    - Testing System Design for PTCR including product tracking using Internet (GE).
    - Panoramic TV PCBs (ACS and HOP) including I^2C communication (Philips).
    - Current Monitoring System for air conditioner controllers (Valeo).

Automation Independent Consultant   **May 2000 – February 2001**
<u>*JOT Automation*</u>   *Monterrey, Nuevo Leon, Mexico.*
- Field service engineering and technical support on JOT automated board-handling equipment.
- International experience in Dominican Republic, USA and Mexico.
- Customer training for the following customers: Nokia, Flextronics, Ademco, Elcoteq, SCI, Celestica, Power One, National Instruments, VOGT, Lexmark and SMTC.

Field Processing Engineer   *June 1998 – October 1999*
<u>*Schlumberger (Geco-Prakla)*</u>   *Houston, Texas, USA.*

- ***International experience working in the USA, England, Brazil and offshore in the Gulf of Mexico for one of the world's largest oilfield services provider.***
- ***Data processing and quality control of seismic engineering projects.***

Teaching Assistant   **January 1996 – May 1998**
Tec de Monterrey, Campus Monterrey   *Monterrey, Nuevo Leon, Mexico.*
- Physics laboratory instructor and Physics teacher.

Awards

Dean's Dissertation Scholarship, 2007-2008.
University of New Mexico Regents Graduate Fellowship Award, 2006-2007.
Outstanding ECE Graduate Student Award of the Year, 2005-2006.
Secretaria de Educacion Publica (Mexican Public Education Agency) Scholarship Recipient, 2004-2007.
Conacyt Scholarship Recipient (Conacyt is the Mexican Science Agency) 2004-2008.
Nuevo Leon College Foundation Excellence Award, October 1996.
Tecnologico de Monterrey Scholarship Recipient, 1996-1998 and 1991-1995.

Training Courses

- Basic Omron PLC Series C Course, Monterrey, Mexico, 2000.
- JOT/Agilent Test Handler Training, Colorado, United States, 2000.
- Basic Safety and Emergency Preparedness Training, England, 1998.
- Seismic Technologies and Related Training, England, 1998.

Affiliations

- IEEE Student Member, January 2007 and *Phi Kappa Phi* Member, April 2007.

Community & Professional Services

- Guest Editor for the Special Issue "Control with Limited Information" in the International Journal of Robust and Nonlinear Control. September 07-January 09.
- Vice-president and Secretary of the ECE Graduate Student Association. September 05-August 07.
- Co-organizer of an invited session in the American Control Conference. July 2007.
- Technical Reviewer for the IEEE Transactions on Automatic Control, IEEE American Control Conference, IEEE Conference on Decision and Control and others.

- Outreach activities promoting Science and Technology Education: School Villa Vista Elementary. School, Queen of Heaven Elementary School, and Desert Ridge Middle School. Nov 04 - May 05.

Publications

Lopez, I., Abdallah, C. and Jayaweera, S. (To appear December 2008)
Conditions for Tracking in Networked Control Systems.
Accepted in Conference on Decision and Control 2008.

Lopez, I., and Abdallah, C. (July 2007)
Rate-Limited Stabilization for Network Control Systems.
Presented in American Control Conference 2007.

Lopez, I., Abdallah, C, and C. Canudas de Wit (July 2007)
Gain-Scheduling Multi-Bit Delta-Modulator for Networked Controlled System.
Presented in European Control Conference 2007.

Lopez, I., and Abdallah, C. (June 2007)
Data Rates Conditions for Network Control System Stabilization.
Presented in IEEE Mediterranean Conference on Control and Automation 2007.

R. Sandoval., C.T. Abdallah, H.N. Jerez, I. Lopez, O. Martinez and D. Lee. (April 2007)   **Networked Control Systems: Algorithms and Experiments.**
Book Chapter in **"Lecture Notes in Control and Information Sciences".**

Martinez O.. Lee D. , Spong M., Lopez, I., and Abdallah, C. (October 2006)
Bilateral Teleoperation of Mobile Robot over Delayed Communication Network: Implementation. Presented in IEEE /RSJ International Conference on Intelligent Robots and Systems 2006.

Lopez, I., and Abdallah, C. (June 2006)
Recent Advances on Control Theory under Communications Constrainsts: A Survey. Presented in IEEE Mediterranean Conference on Control and Automation 2006.

Lopez, I., Piovesan, J., Abdallah, C., Lee D., Martinez O., Spong M., Rodriguez R. (June 2006)
Practical Issues in Networked Control Systems. Presented in American Control Conference 2006.

Lopez, I., Valenzuela, M. (October 1998)
Design of Digital PID Controllers by Means of Genetic Programming (in Spanish).
Presented in *Taller de Inteligencia Artificial* 1998

Feng Shi, PhD
Assistant Professor, *Northern New Mexico College*

Department of Physics and Astronomy, *University of Toledo*, Ph.D, 2008
Department of Electrical and Computer Engineering, *University of Rochester*, M.Sci.. 2002.
Solar Energy Research Institute, Yunnan Normal University, P. R. China, Master of Mechanical Engineering. 1998
Department of Physics, *Northwest Normal University*, P. R. China, B.Sci. 1985

Experience

Solar Energy Research Institute, Yunnan Normal University, P. R. China, Assistant Professor. (7/1991-12/1999)

In charge of graduate education, research project development, research team establishment, laboratory construction, technology innovation and commercialization.

- Developed and constructed 2 core courses in advanced level for Master's program in solar thermal research and application, namely " Advanced solar thermal application materials" and " Solar energy thermal conversion"
- Supervised research of 2 graduate students in solar powered refrigeration and air conditioning field helping them successfully finished research work and found faculty positions in famous universities in China based on their research achievement.
- Successfully developed 2 research directions, namely "Solar powered refrigeration and air conditioning", " Novel balloon type sunlight concentration system", and got 2 research projects funded by natural science foundation of Yunnan Province.
- Innovated and commercialized a new type solar water heater technology, namely " Cone cylinder integrated with plate fin type solar water heater".
- Executed strategic planning of research facilities of Yunnan province renewable energy key laboratory and carried out equipments purchase.
- Served as renewable energy specialist in providing consultant for national government supported renewable energy county construction projects in Yunnan province.

Department of Electrical and Computer Engineering, University of Rochester, US, Visiting Scientist. (12/1999-1/2001)

 "Laboratory for Laser Energetics ", " The Cornell NanoScale Science & Technology Facility (CNF) ", " The Institute of Optics at Rochester " and " Semiconductor Fabrication Laboratory " in Department of Electrical and Computer Engineering of

University of Rochester. Involved in fabrication and characterization facilities and conduct research work on " Porous Poly-crystalline Silicon Thin Film Solar Cells "

- Completed training and skillfully used semiconductor and device fabrication and characterization facilities such as LPCVD, EBD, Sputter, plasma etching, SEM, TEM, etc.
- Completed electrochemical fabrication of nano-scale silicon materials porous silicon, finished research work on fabrication conditions and processes for N and P type materials with different doping levels, finished materials property characterization such as porosity, reflection and transmission.
- Carried out investigation on "Porous Poly-crystalline Silicon Thin Film Solar Cells", including polycrystalline silicon thin film deposition, thermal diffusion doping, electrochemical etching to form porous silicon, photolithography electrode pattern formation, and solar cell properties characterization.
- Achieved photovoltaic conversion efficiency of porous polycrystalline silicon thin film solar cell to 2%.
- Involved electrochemical fabrication of 2 dimensional photonic band gap material fabrication on N type silicon wafer.
- Completed investigation of photonic crystal optical fiber for use in semiconductor fabrication.

Future Work

Interested in novel solar energy photovoltaic system and solar powered CO_2 recycling , H_2 storage, and fuel making system, in order to achieve breakthrough technology in energy storage which would play a leading role in renewable energy applications.

Techniques

Simulated 3 dimensional nucleation and growth of thin film in Kinetic Monte Carlo method, simulated 2 dimensional coarsening process in parallel Kinetic Monte Carlo method, working on DFT calculation of micro electronic structure of materials. Experience in:

- System and devices modeling.
- Monte Carlo simulation of complex system.
- Parallel computation of large systems for long time scale.
- DFT calculation of atomic micro-electronic structures.

Research Projects:

- Kinetic Monte Carlo (KMC) Simulation of Nucleation and Growth in Materials and on Surfaces. *University of Toledo*. Employed KMC method to simulate cluster nucleation and growth in bulk materials and on surfaces of solid materials.

- High Efficiency Thin Film Triple Junction a-Si/Ge Solar Cells. *University of Toledo.* Work on fabrication process to improve performance of triple a-Si/a-SiGe/a-SiGe junction thin film solar cell by optimizing the process variables.

- Porous Poly-crystalline Silicon Thin Film Solar Cells. University of Rochester. Using a novel nano-scale material-porous silicon generated from poly-silicon to fabricate thin film solar cell. Attempt was made to improve the quantum efficiency and light trapping property of silicon solar cell by employing this nano-scale material.

- Balloon Type Concentrator Combine Light Wave Guide, Sunlight Concentration and Transportation System. *Yunnan Normal University*. Supervised a research project funded by Yunnan Natural Science Foundation. Attempt was made to construct a new type of sunlight concentrating and transferring system to realize large scale sunlight concentration and transportation with low cost and high efficiency.

- Solar Solid Adsorption Heat Pump. *Yunnan Normal University*. Involved in improving the heat transfer between solar collector and solid adsorbent in solid adsorption bed, and the heat-mass transfer between the adsorbent and working fluid. The numerical simulation of heat-mass transfer in solid adsorption bed was finished and an experimental apparatus was constructed.

- Solar Thermal System Combined with Photovoltaic Collector. *Yunnan Normal University*. Supervised a research project funded by Yunnan Provincial Science and Technology committee to fabricate a thermal and photovoltaic hybrid collector to supply heat and electricity to solar powered cooling system.

- Transparent Insulation Materials. *Yunnan Normal University*. Supervised a research project funded by Yunnan Provincial Education Committee Foundation.

- Collector-Storage Integrated Type of Solar Water Heater. *Yunnan Normal University*. Innovated two kinds of collector-storage integrated types of solar water heaters, finished numerical analysis, design parameter optimization, and experimental test. Successfully commercialized one of the technologies.

Awards

Honorable Mention, Link Foundation Energy Fellowship, *University of Rochester*, USA, 2002
Outstanding Undergraduate Student, *Northwest Normal University*, China, 1983

US Patent Pending

Feng Shi, A lightweight low-cost solar concentrator and a method for its production.
11/716905, Feng Shi and Yingfeng Li, Parallel integrated solar cell circuits for spectrally spliced light sources.

11/704781,Feng Shi, Photonic crystal optical wave guide solar spectrum splitting integrated circuit photovoltaic system.
11/593228, Feng Shi, Photonic crystal wave guide optical spectrometer.

Patents

CN99111767.0, A solar powered cooling and heating combination system.
CN00129169.6, Plate solar collector heating and air conditioning supply system and its fluid circulation method.

Presentation

APS March Meeting, Montreal, Canada, 2004
APS March Meeting, Los angles, USA, 2005
APS March Meeting, Baltimore, USA, 2006

Publications

Feng Shi, Yunsic Shim and Jacques G. Amar, "Parallel Kinetic Monte Carlo
Simulation of Two Dimensional Coarsening," *Phys. Rev.* E, **76**, 031607 (2007)

Feng Shi, Yunsic Shim and Jacques G. Amar, "Upper Critical Dimension for Irreversible Cluster Nucleation and Growth," *Phys. Rev.* E **74**, 021606 (2006)

Feng Shi, Yunsic Shim and Jacques G. Amar, "Island-size distribution and capture numbers in three-dimensional nucleation: Comparison with mean-field behavior," *Phys. Rev*. B 71, 245411, (2005)

C. C. Striemer, F. Shi, and P. M. Fauchet, "Electrochemical etching of silicon substrates for photovoltaic applications," *199th Electrochemical Society Conference,* Washington, DC, 25-30 March 2001.

C. C. Striemer, F. Shi, S. P. Duttagupta, and P. M. Fauchet, "Porous Silicon Texturing of Polysilicon Substrates," *28th IEEE PV Specialists Conference*, Anchorage, AK, 17-22 September 2000, pp932-935(2000).

Shi Feng, et al, Study on Design of Solar Powered Solid Adsorption Refrigeration System, *New Energy Sources*, pp 5-11, 20(11), 1998.

Li Ming, Wang Ruzhu, Shi Feng, Research and prospect on solar solid adsorption refrigeration system, New energy sources, pp 6-12, 20(2), 1998.

Shi Feng, et al, "Experimental Comparison of Performance of Integrated Solar Water Heater of Cone Tube-fin Structure and Flat plate Solar Water Heater," *New Energy Sources,* pp 1-6, 19(11),1997.

Shi Feng, et al, "Research and Development of Transparent Insulation Technology," *New Energy Sources*, pp22-28,19(3), 1997

Liao Hua, Shi Feng, "Study of A New Type of Transparent Insulation Material," *New Energy Sources*, pp32-34, 19(4), 1997

Shi Feng, et al, "Promise of Developing Passive Solar House in High and Cold Mountain Area of Yunan Province," *New Energy Sources,* pp39-42, 19(9), 1997.

Zhang Xuejun, Shi Feng, Zeng Yanxing, "Theoretical Analysis on Ideal Basic Cycles of The Solid Adsorption Refrigeration/Heat Pump System," *New Energy Sources*, pp16-22, 19(9), 1997

Xie Fuyao, Zheng Qinhong, Lin Weigan, Shi Feng, "Theorem of the Optical Fiber Transmission of Solar Energy and its Application Technology," *New Energy Sources,* pp 26-30, 19(8), 1997

Fangyang Shen
Assistant Professor
Northern New Mexico College

EDUCATION

Aug. 2008	**AUBURN UNIVERSITY** Auburn, AL, U.S.A.

Aug. 2008   **AUBURN UNIVERSITY**   Auburn, AL, U.S.A.
Ph.D. in Computer Science and Software Engineering
- Concentrated in Wireless Networks and Storage Systems
- Dissertation: Improving System Performance for Wireless Networks

Jun. 2004   **GUANGDONG UNIVERSITY OF TECHNOLOGY** Guangzhou, P.R. China
M.Eng. in Computer Science and Engineering
- Thesis: Enhancing Security for WLAN

Jun. 2001   **GUANGDONG UNIVERSITY OF TECHNOLOGY** Guangzhou, P.R. China
B.Eng. in Computer Science and Engineering
- Thesis: Human Resource Management Information Systems

Jun. 1997   **GUANGDONG UNIVERSITY OF TECHNOLOGY** Guangzhou, P.R. China
Associate Degree in Computer Science and Engineering
- Thesis: Design of Graphics Transportation System in Real Time Traffic Accidents

RESEARCH INTERESTS

Wireless Networks, Network Security, Storage Systems, Reliability and Modeling, Energy and Power Management

RESEARCH EXPERIENCE

Aug. 2008 – Current
     NORTHERN NEW MEXICO COLLEGE Espanola, NM, U.S.A.

     Tenure Track Assistant Professor, Program Director
- Program director for software engineering program

Jan. 2005 – Jul. 2008
     AUBURN UNIVERSITY Auburn, AL, U.S.A.

     Research Assistant, Advisor: Dr. Min-Te Sun
- Design routing protocols for Wireless Mesh Networks
- Tools: Graph Theory, NS2, QualNet, and C++

Jul. 2007 – Aug. 2008
     AUBURN UNIVERSITY Auburn, AL, U.S.A.

Collaborator: Dr. Xiao Qin

- Develop mathematical models for Parallel Disk Systems
- Tools: Stochastic Process, Matrix Theory, MATLAB
- Support by NSF-CSR: CNS-0713895

Aug. 2004 – May 2005

AUBURN UNIVERSITY Auburn, AL, U.S.A.

Research Assistant, Supported by Dr. Levent Yilmaz

- Designed multi-level architectures for emotion systems

Sep. 2001 – Jun. 2004

GUANGDONG UNIVERSITY OF TECHNOLOGY Guangzhou, P.R. China

Research Assistant, Guided by Prof. Zhenkun Li

- Designed computer information systems and e-business systems
- Created e-business website
- Tools: ASP, Java, and C++

TEACHING EXPERIENCE

Aug. 2008 – Dec. 2008

NORTHERN NEW MEXICO COLLEGE Espanola, NM, U.S.A.

Assistant Professor, Department of Engineering

- Course: "Computer Literacy"
- Course: "Real Time Systems"
- Course: "Networking Fundamentals"

Aug. 2004 – May 2008

AUBURN UNIVERSITY Auburn, AL, U.S.A.

Teaching Assistant, Department of Computer Science and Software
Engineering

- Course: "MATLAB Programming"
- Taught for 8 semesters

May 2007 – Jul. 2007

AUBURN UNIVERSITY Auburn, AL, U.S.A.

Instructor, Department of Computer Science and Software
Engineering

- Course: "Personal Computer Applications"

Jan. 2007 – May 2007

AUBURN UNIVERSITY Auburn, AL, U.S.A.

Teaching Assistant, Department of Agriculture

- Course: "Computer Applications in Agriculture"

Sep. 2003 – Jul. 2004

GUANGZHOU INSTITUTE OF TECHNOLOGY Guangzhou, P.R. China

Instructor, Department of Computer Science
- Course: "Introduction to Computer Networks"
- Taught 3 classes

Instructor, Department of Computer Science
- Course: "Operating Systems"
- Taught 2 classes

Sep. 2003 – Jan. 2004

GUANGDONG VOCATIONAL COLLEGE OF INDUSTRY & COMMERCE
Guangzhou, P.R. China

Instructor, Department of Computer Science and Engineering
- Course: "Computer Network Engineering"
- Taught 2 classes

Sep. 2003 – Jan. 2004

GUANGZHOU ELECTRONICS & INFORMATION SCHOOL
Guangzhou, P.R. China

Instructor, Department of Computer Science
- Course: "Computer Communication Network & Application"
- Taught 1 class

Feb. 2003 – Jul. 2003

GUANGDONG UNIVERSITY OF TECHNOLOGY
Guangzhou, P.R. China

Instructor, Department of Computer Science and Engineering
- Course: "Internet Technology and Its Application"
- Taught 2 classes

INDUSTRIAL EXPERIENCE

Jul. 1997 – Aug. 2001

GUANGDONG FUEL COMPANY
Guangzhou, P.R. China

Business Information System Designer and Database Manager
- Designed and maintained Business Financing System, Business Management Systems
- Enhanced information security of financing, business and fixed assets management systems
- Trained employees to use Business Information Systems, network technology

GRANT WRITING

- Co-PI to submit a proposal of "Photonic Crystal Enabled Integrated Circuitry Photovoltaics: Ultra-high Conversion Efficiency at Low Cost Design" to NSF, Sep. 2008
- Completed " Grant Proposal Writing" course at Auburn University, Fall 2007

COMPUTER SKILLS

- Languages: C/C++, JAVA, MySQL, PHP, Oracle, Perl, MATLAB, QualNet, NS2
- Other: UNIX, LINUX, XP, Visio, Latex, Gnuplot

PUBLICATIONS

- **F. Shen**, M.-T. Sun, C. Liu, and A. Salazar, "A Sleep Scheduling Algorithm for Cluster-based Sensor Networks," *submitted to 2008 IEEE Consumer Comm. and Networking Conf.,* Sep. 2008.
- **F. Shen**, M.-T. Sun, C. Liu, "Coverage-Aware Scheduling for Cluster-based Sensor Networks," *submitted to 2008 IEEE Wireless Comm. and Networking Conf.,* Sep. 2008.
- **F. Shen,** X. Qin, M.-T. Sun, and A. Salazar, "A Reliability Model of Energy-Efficient Parallel Disk Systems with Data Mirroring," *submitted to Int'l Conf. Performance Computing and Comm. Conf.,* Sep. 2008.
- K. Sakai, **F. Shen**, and M.-T. Sun. "Multi-Initiator Connected Dominating Set Construction for Mobile Ad Hoc Networks," *Int'l Conf. Communications,* pp. 2431-2436, May. 2008.
- C. Liu, **F. Shen**, M.-T. Sun, "A Unified TCP Enhancement for Wireless Mesh Networks," *Proc. 2007 Int'l Conf. Parallel Processing Workshops,* pp. 71-76, Sep. 2007.
- **F. Shen**, Z. Li et al., "Study On the Security Mechanism of WLAN," *Jour. Guangdong Univ. Tech.,* Vol. 21, No. 3, pp. 69-73, Sep. 2004.
- G. Han, W. Li, F. Lu, **F. Shen**, "Agent-Oriented Grid Middleware Model," *Jour. Guangdong Univ. Tech.,* Vol. 21, No. 2, pp. 50-53, Jun. 2004.
- Z. Huang, **F. Shen** et al., "Research on Principles and Countermeasures for DDoS," *Computer and Moderization,* pp. 73-79, Mar. 2004.
- J. Ruan, **F. Shen** et al., "Exploring WLAN Security," *Computer and Moderization,* pp. 76-79, Mar. 2004.
- **F. Shen**, Y. Chen et al., "The Criterion and Overview on Selecting Firewall Products," *Application Research of Computers,* Nov. 2003.
- **F. Shen**, J. Ruan et al., "Configurations and Selections of Firewall Products," *Jour. Guangdong Univ. Tech.,* Vol. 20, No. 3, pp. 40-45, Sep. 2003.
- **F. Shen**, Z. Li et al., "Strategies to Prevent DDoS," *Microcomputer Development,* Vol. 13, No. 9, pp. 46-52 , Sep. 2003.
- Z. Liu, H. Liu, Z. Li, **F. Shen**, "Study on Programming Interface of XML and An Application Model," *Microcomputer Development,* Vol. 13, No. 2, pp. 61-63, Jun. 2003.

- Y. Chen, **F. Shen** et al., "Research on Technique of Broad-Band IP MAN and Its Development," *Guangdong Automation & Information Engineering,* Vol. 24, No. 2, pp. 32-34, Mar. 2003.
- **F. Shen**, Z. Huang et al., "Prospective of Firewall Products," *Guangdong Automation and Information Engineering,* Vol. 24, No. 1, pp. 24-26, Jan. 2003.

PROFESSIONAL ACTIVITIES

- Member of IEEE, ACM, and USENIX
- Technical Program Committee member for ITNG 2009, AESN 2009, CSIE 2009, CCNC 2009, and IMSAA 2008
- Reviewer for IEEE Transactions on Reliability, Future Generation Computer Systems, INFOCOM 2009, CHINACOM 2008, AINA 2008, CCNC 2008, MILCOM 2008, AccessNets 2007, ISWCS 2007
- Volunteer and Participant for INFOCOM 2007, SECON 2007, GLOBECOM 2007
- Participant for Robert C. Thompson Matrix Meeting 2007 and Vodafone Symposium 2007
- Completed QualNet training in Washington, D.C. in Aug. 2007

SELECTED AWARDS

- Nominated as a candidate and completed "Auburn University Preparing Future Faculty Program"
- Represented Auburn University Men's Table Tennis Team to play NCTTA 2007 for team honors,
  Auburn placed 16th
- Third-place prize winner in the Mathematical Contest of Modeling of Guangdong Province in 1996
- Ranked 4th in the Third Mathematical Contest of Zhu-Chong-zhi Cup in Raoping County in 1990

Jorge Crichigno, PhD

Research Interest
Wireless networks: routing and scheduling schemes in multi-hop wireless networks, protocols and optimization frameworks, multi-access channels in large wireless networks. Optical networks: routing and wavelength assignment in next-generation SONET/SDH networks. FPGA networks: lightweight MAC and routing protocols for FPGA-based networks, task scheduling.

Education
Ph.D. in Computer Engineering, 2009
University of New Mexico, Albuquerque - NM.
M.S. in Computer Engineering. 2008
University of New Mexico, Albuquerque - NM.
GPA: 4/4
B.S. in Electrical Engineering. 2004
Catholic University, Asuncion - Paraguay.
GPA: 4.16/5

Awards
- Nominated for best paper award- *IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks,* Greece, June 15-19, 2009.
- NSF Student Travel Grant for IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks, Greece, June 15-19, 2009.
- Ranked number 1 in Computer Engineering in the Qualifying Exam for Ph.D., University of NewMexico, 2006.
- Distinction on undergraduate thesis. Catholic University, Asuncion - Paraguay, 2004.
- Won Research Project Funds of the Catholic University, project Multi-objective Multicast Routing over IP Networks, Asuncion - Paraguay, 2003.

Professional and Academic Experiences
University of New Mexico. Research Assistant. Aug. 2005 - Jan. 2007, Aug. 2007 - Present.
- Research activities: develop optimization models and protocols for multi-hop wireless networks. Design and prototype next generation Internet architectures as part of NSF FIND initiative, including heterogeneous wireless mesh and FPGA-based architectures.
- Devise routing and wavelength assignment schemes for optical networks.
- Teaching activities: lecturer and laboratory instructor. Teach hardware description language (VHDL).
- Design laboratory sessions for a course on hardware and software codesign using Xilinx Virtex-II.

Shanghai Jiao Tong University, Shanghai - China. Feb. 2007 - Aug. 2007.
- Research activities: designed a distributed dynamic programming protocol for routing in IEEE 802.11 multi-radio wireless mesh.

- Teaching activities: lectured on special topics in wireless networks, including channel assignment and routing in wireless mesh networks.

Catholic University, Asuncion - Paraguay. Feb. 2003 - Aug. 2005.
Teaching activities: lectured in Computer Networks course (400 hundred level). Designed laboratory sessions which included implementation of application level protocols using TCP/UDP sockets, and design of link and routing protocols in CNET network simulator (http://www.csse.uwa.edu.au/cnet3/).

Conexion Group, Asuncion - Paraguay. Junior Engineer. Jan. 2004 - Jul. 2005.
Designed and operated a carrier-class IP network interconnecting several point-of-presences in South and North America, such as Asuncion (Paraguay), Sao Paulo (Brazil), Buenos Aires (Argentina), Miami (http://www.conexiongroup.com/espanol/).

Continuous Computing Corporation, San Diego - California. Aug. 2004
Implemented a SIGTRAN protocol stack to transport SS7 (telephone signaling protocol) over IP networks (www.ccpu.com).

National Computing Center, Paraguay. Research Assistant. Jan. 2003 - Jan. 2004
Developed multi-objective multicast protocols for IP networks.

Societies and Technical Groups
Transient Network Architecture group at CNRI/UNM (www.tna.cnri.net).
High-Speed Networking Laboratory group at UNM (http://ece.unm.edu/hsnl/).
Future Internet Design (FIND) student research group (http://www.ece.unm.edu/¯nd/).
Student Member of the IEEE society.

Papers in Refereed Conferences
[1] J. Crichigno, C. Xie, W. Shu, M. Y. Wu. N. Ghani, *A Multi-Objective Approach for Joint Throughput and Tra±c Engineering Optimization in Optical WDM Networks*, submitted to IEEE Asilomar 2009, California, November 2009.
[2] J. Crichigno, M. Y. Wu, W. Shu, *A Joint Routing and Scheduling Scheme for Wireless Networks with Multi-packet Reception and Directional Antennas*, IEEE 10*th* International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM 2009), Greece, June 2009.
[3] J. Crichigno, M. Y. Wu, W. Shu, *Throughput Optimization in Wireless Networks with Multi-packet Reception and Directional Antennas*, IEEE Wireless Communications and Networking Conference (WCNC) 2009, Budapest, Hungary, April 2009.
[4] J. Crichigno, J. Khoury, M. Y.Wu, W. Shu, *A Dynamic Programming Approach for Routing in Wireless Mesh Networks*, IEEE Global Communications Conference (Globecom) 2008, New Orleans, LA, USA, December 2008.
[5] J. Khoury, L. DeCicco, H. Jerez, J. Crichigno, C. Abdallah, W. Shu, G. Heileman, *Design and Implementation of a Framework for Persistent Identi¯cation and Communication in Emerging Networks*,
Proceedings of the 4*th* International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (Tridentcom 08), Innsbruck, Austria, March 2008.
[6] J. Khoury, J. Crichigno, C. T. Abdallah, W. Shu, G. Heileman, H. Jerez, *The InterMesh Network Architecture*, 13*th* Annual International Conference on Mobile Computing and Networking (Mobicom 2007), Demo, Montreal, Canada, September 2007.

[7] J. Prieto, B. Baran, J. Crichigno, *Multitree-Multiobjective Multicast Routing for Tra±c Engineering*, Artificial Intelligence in Theory and Practice: IFIP 19*th* World Computer Congress, Santiago, Chile, August 2006.

[8] F. Talavera, B. Baran, J. Crichigno, *Policies for Dynamical MultiObjective Enviroment of Multicast Tra±c Engineering*, IEEE 12*th* International Conference on Telecommunications, South-Africa, May 2005.

[9] J. Crichigno, B. Baran, *Multiobjective Multicast Routing Algorithm for Tra±c Engineering*, IEEE 13th International Conference on Computer Communications and Networks, Chicago, IL, USA, October 2004.

[10] J. Crichigno, F. Talavera, J. Prieto, B. Baran, *Multicast Routing using Multiobjective Optimization*, 10*th* Argentine Conference on Computer Sciences, Argentina, October 2004.

[11] F. Talavera, J. Prieto, J. Crichigno, B. Baran, *A Comparative Study of Multiobjective Evolutionary Algorithms in a Multicast Environment*, 10*th* Argentine Conference on Computer Sciences, Argentina, October 2004.

[12] J. Crichigno, B. Baran, *Multiobjective Multicast Routing Algorithm*, IEEE 11*th* International Conference on Telecommunications, Brazil, August 2004.

[13] J. Crichigno, B. Baran, *Multicast Routing Algorithm using Multiobjective Optimization*, IEEE 11th International Conference on Telecommunications, Brazil, August 2004.

Papers in Refereed Journals

[1] J. Crichigno, M. Y. Wu, S. K. Jayaweera, W. Shu, Exploiting Multi-packet Reception and Directional Antennas in Multi-hop Wireless Networks, submitted to IEEE Transactions on Parallel and Distributed Systems, 2009.

[2] J. Crichigno, M. Y. Wu, W. Shu, *Protocols and Architectures for Channel Assignment in Wireless Mesh Networks*, Ad Hoc Networks, Volume 6, Issue 7, September 2008.

Technical Reports

[1] J. Khoury, J. Crichigno, H. Jerez, C. Abdallah, W. Shu, G. Heileman, *The InterMesh Network Architecture*, University of New Mexico, Technical Report EECE-TR-07-007, April 2007, [online]: http://hdl.handle.net/1928/3052.

[2] J. Crichigno, *An RTP/SIP Conference Server Based on Linear Mixing Streams*, Technical Report, May 2006. [online]: http://www.ece.unm.edu/»jcrichigno/confsTR.pdf.

Technical Skills

 Network protocols: SIP, SDP, RTP, TCP, UDP, IP, ICMP, DSR, 802.11, Ethernet 802.3, Distributed Coordination Function (DCF).

Mathematical modeling and optimization tools: General Algebraic Modeling System (GAMS), LP-SOLVE (C, MatLab) (used to model and solve linear and mixed integer linear programs).

Programming Languages: C, C++, Pascal, Assembler (Motorola 68HC11), UNIX shell scripting, VHDL, C for Xilinx Virtex-II PowerPC embedded processor, LabView (data acquisition).

Simulation Tools: MatLab, Simulink, discrete-event simulators such as Network Simulator 2 (NS-2), ModelSim, OPNET, CNET.
Hardware Design: VHDL, RTL hardware design, behavioral design. Xilinx development kits, Virtex-II Pro and Spartan-3E. Xilinx PowerPC embedded processor. Motorola 68HC11 microcontroller.
Development tools: Linux gcc, multi-threading and mult-process programming, distributed and parallel computing, Socket Programming (i.e., TCP, UDP, IP, raw Ethernet 802.3), Windows Driver Development Kit (DDK).
Circuit Design: The SPICE Circuit Simulator, EAGLE Cad/Cam Software for PCB Schematic and Layout, Orcad, Xilinx ISE tools.
Operating Systems: MS Windows, Linux, Unix.
Testing tools: Parasoft (Object Oriented Testing).
Languages
Native Spanish, English.

References
[2] Dr. Wennie Shu. Associate Professor, Associate Chair, Director Graduate Program, Electrical and Computer Engineering Department, University of New Mexico, NM, USA. Phone: (505) 277-8471. Email: shu@ece.unm.edu. Website: http://www.ece.unm.edu/»shu/
Dr. Nasir Ghani, Professor, Associate Professor, Director High-Speed Networking Laboratory, Electrical and Computer Engineering Department, University of New Mexico, NM, USA. Phone: (505) 277-1475. Email: nghani@ece.unm.edu. Website: http://www.ece.unm.edu/»nghani/
 Dr. Marios Pattichis, Associate Professor, Electrical and Computer Engineering Department, University of New Mexico, NM, USA. Phone: (505) 277-0486. Email: pattichis@ece.unm.edu.Website: http://www.ece.unm.edu/faculty/pattichis/
Dr. Gregory Heileman, Professor, Associate Chair, Director Undergraduate Program, Electrical and Computer Engineering Department, University of New Mexico, NM, USA. Phone: (505) 277-2630. Email: heileman@ece.unm.edu. Website: http://www.eece.unm.edu/faculty/heileman/
Dr. Min-You Wu. IBM Chair Professor, Department of Computer Science and Engineering, Shanghai JiaoTong University. Research Professor, Electrical and Computer Engineering Department, University of New Mexico. Email: mwu@sjtu.edu.cn. Website: http://www.ece.unm.edu/»wu/

Appendix D
<div align="center">

Survey Results – Community & Students
</div>

A. Community:

Brian Sanderoff, noted Survey specialist, conducted three types of surveys in the summer of 2007 – the first soliciting input from students and advisors in area high schools, the second from commercial and industrial entities located in the area and the third from general community members. The questions on the survey concerned the importance of having certain academic programs at Northern New Mexico College. The results indicated that degrees in Mechanical Engineering were among the top ten in a ranking of importance.

The NNMC College of Engineering Advisory Council unanimously approved the program on November 6, 2008.

The Espanola City Council passed a resolution supporting the program on November 25, 2008.

A. Students:

Twenty three seniors in the engineering field were polled during a meeting on August 19, 2008 on their interest in attending a Master's program at NNMC in an engineering field either ME or Information Technology. The students responded positively to the question with a near unanimous vote.

Appendix E

<div align="center">

Northern New Mexico College
College of Engineering
Graduate Course Offerings

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COMPUTER SCIENCE (CS)

CS542/442 INTRODUCTION TO PARALLEL PROCESSING. Machine taxonomy and introduction to parallel programming. Performance issues, speed-up and efficiency. Interconnection networks and embedding. Models of data flow. (3, 3+0L) Pre-requisites: CS251L, CS341L; Spring

CS551/451 DESIGN OF LARGE PROGRAMS. Object-oriented analysis, design and programming. Programming language issues, programming tools and other computer science concepts for the project control and management. (3, 3+0L) Pre-requisites: CS241, CS251; Spring

CS570/470. SOFTWARE QUALITY ASSURANCE. This course software quality assurance principles and best practices. Topics covered include software requirements, verification and validation, structural testing, functional testing, software testing metrics and strategies, bug-tracking tools, software quality assurance and engineering. Pre-requisite: CS152L (3, 3T+0L)

CS599/499 TOPICS IN CS – Assignment of a project for individual or team execution. Requirements, planning, research, implementation and recommendations or conclusions can form one or more of the phases of the project. (X, X+0L) – variable credits up to 3 hrs.

ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING (EECE)

EECE 540 COMPUTER ARCHITECTURE
Advanced topics in computer architecture and design. These include processor systems, integration of memory, processing speed, microcode structures, operating system design, task management, hardware/software interface design, economic and complexity considerations in computer design. (3,3T+0L) Spring

EECE541 INTRODUCTION TO COMMUNICATION SYSTEMS Modulation methods – amplitude, phase, frequency and pulse dimensional. Sideband shaping, synchronous and asynchronous mod/demod, timing recovery, phase-lock loops, equalizers – fixed and self-adjusting. Linear and nonlinear impairments, effects of noise. Spread spectrum by code or frequency-hopping. (3, 3+0L) Pre-requisites: EECE314, EECE340; Fall

EECE547/447 ROUTING AND SWITCHING

Computer networking principles and operational structures of bridges, routers, brouters. Packet switching techniques, routing protocols and packet processing algorithms. Pre-requisite: IT330. (3, 3T+0L)

EECE550/450 ADVANCED DATA ORGANIZATION & STRUCTURES. Advanced topics in the representation of data, its storage and manipulation. Memory organization, both virtual and real, of data storage and its relation to computation and efficiency. Topics include linked versus contiguous implementation, memory management, the use of indices and pointers and an introduction to issues raised by the memory hierarchy. (3, 3+0L) Pre-requisite: CS152L; Fall

EECE560/435. SOFTWARE ENGINEERING. This course covers software engineering principles and best practices. Topics covered include requirements review, design reviews, modeling the software process and life cycle, planning and managing the software project, designing, delivering and maintaining the software systems. Pre-requisite: EECE152L(3, 3T+0L)

EECE599/499 TOPICS IN EECE – Assignment of a project for individual or team execution. Requirements, planning, research, implementation and recommendations or conclusions can form one or more of the phases of the project. (X, X+0L) – variable credits up to 3 hrs.

ENGINEERING (ENGR)

ENGR570/470 ENGINEERING MANAGEMENT I. Business principles for first-time engineering, science or technology managers. Topics covered include time and budget management, employee and organization management, team building & rewards, and project strategy. (3,3+0L) Pre-requisite: ENG 111. Fall, Spring

ENGR571/471 ENGINEERING MANAGEMENT II. Advanced management principles for mid-level and executive engineering managers. Technology and science strategies at the organization or corporate level. Technology transfer, valuation and transactions. (3,3+0L); Pre-requisite: ENGR 570. Spring

ENGR572/472 ENTREPRENEURIAL ENGINEERING. Principles of entrepreneurship, marketing, people management and team building for technology-based start-ups. Best practices in the formation of a company focused on product and service innovations. Student teams are trained in business plan assembly, presentation and defense. (3, 3+0L); Pre-requisite: ENG 111. Spring;

ENGR573/473 FINANCING ENGINEERING COMPANIES. The evaluation, financing and the investor oversight of technology or engineering start-ups. Investment principles applied to technological innovation, the interaction between entrepreneurial teams, investors and private/public financing markets. (3, 3+0L); Pre-requisite: MATH 160, ENG 111. Fall;

ENGR574/474 ENGINEERING PROJECT MANAGEMENT. An introduction to the methods underlying modern project management in the development of engineering software, hardware or systems products. Specific topics include team formation, status reporting, project management tools and management of cross-disciplinary teams. (3, 3+0L); Pre-requisite: ENG 111. Spring;

ENGR575/475. **DEVELOPING ENGINEERING PRODUCTS** The art and science of managing engineering product development from the requirements phase to the testing phase and customer delivery and support. Rapid time to market principles are reviewed along with product platform design processes. (3, 3+0L); Pre-requisite: MATH 160, ENG 111. Fall;.

ENGR576/476 MARKETING ENGINEERING PRODUCTS. Marketing principles of science, technology or engineering products and services. Best practices in product research, competitive analysis, sales/marketing incentives and acquisition of technology products are reviewed. (3, 3+0L); Pre-requisite: ENG 111. Spring;

ENGR577/477 TECHNOLOGY TRANSFER –EAST/WEST. Historical, political, financial and cultural aspects of technology transfer between countries in the western hemisphere and those in the eastern hemisphere with particular emphasis on India and China in Asia and the United States. Review of bargaining strengths held by parties in the negotiation will be followed by a study of subsequent development of technology through financial transactions, joint ventures and licensing agreements. (3, 3+0L) Pre-requisite: ENG 111; Fall;

ENGR578/478 ENGINEERING ETHICS. The impact of engineering decisions in product design, testing and marketing is reviewed in light of cases that depict appropriate and inappropriate ethical behavior in engineering organizations. Cultural, ethnic and historical factors in the formation of ethical systems are also reviewed. (3, 3+0L); Pre-requisite: ENG 111; Fall;

ENGR579/479 ENGINEERING FACTORS IN CORPORATE STRATEGY. The influence, contributions and interdependency of engineering innovation on financing and market needs are studied as they relate to corporate strategy and advancement. The concepts of core competencies, engineering equity and high performance teams are reviewed in terms of corporate assets. (3, 3+0L); Pre-requisite: ENG 111; Spring;

INFORMATION TECHNOLOGY (IT)

IT510/410 INFORMATION ASSURANCE AND SECURITY
Information systems security fundamentals and tools, emphasizing the role of general and application systems controls in protecting data and computing resources, the identification of threats, and the administrative and technological tools and techniques used to audit and monitor access and access control. Pre-requisites IT330 and IT350. (3, 3T+0L)

IT530/430 NETWORK ADMINISTRATION
The practice of network administration in organizations in which security, application control, software updates, hardware inventory control and operational costs are of paramount importance. Economic modeling of organizational tasks in capital outlay, operational budgets and expense savings. (3, 3T+0L)

IT599/499 TOPICS IN IT
Assignment of a project for individual or team execution. Requirements, planning, research, implementation and recommendations or conclusions can form one or more of the phases of the project. (X, X+0L) X – variable credits.

MECHANICAL ENGINEERING (ME)

ME501/401 ADVANCED MECHANICS OF MATERIALS. State of stress and strain at a point, stress-strain relationship; topics in beam theory such as asymmetrical bending, curved beams, and elastic foundations; torsion of non-circular cross-sections; energy principles. (3, 3+0L) Pre-requisites: ME306; Spring

ME503/403. SOLAR THERMAL APPLICATIONS Thermal processes of solar energy conversion in solar engineering. Topics covered include solar radiation, solar harnessing equipment and system, solar materials and properties, solar heat transfer theory, solar economics, solar applications and solar system design. (3, 3+0L) Spring;

ME509/409 POWER SYSTEMS Mechanical and electrical properties of machinery for power generation or deployment. Network or grid design of distribution of power. Sources of electric power and their characteristics of energy conversion efficiency, cost and environmental impact. Introduction to electric energy storage. (3, 3+0L) Pre-requisites: ME306, ME317, EECE203L; Spring. Cross-listed with EECE 509/409

ME543/453 ELECTRIC ENERGY STORAGE DEVICES Electrochemical, electrostatic and electromechanical processes for storage of electrical energy. Design of storage systems. Storage efficiency measures. (3, 3+0L) Pre-requisites: EECE321, PHYS216; Fall. Cross-listed with EECE543/453

ME552/452 POWER CONTROLLERS Power supply design. DC-DC and DC-AC conversion devices, electric power measurement devices, frequency and power level stabilizers. Regulators, smart metering. (3, 2+1L) Pre-requisite: EEE321; Spring Cross-listed with EECE552/452

ME570/470 MICROPROCESSORS IN MECHANICAL SYSTEMS Introduction to microprocessor organization, interfacing, machine and assembler-language programming. Several projects involving the use of a microcontroller in various mechanical systems. (3, 3+0L) Pre-requisites: Senior or graduate standing or permission of instructor; Fall

ME572/472 PV DEVICES Photovoltaic effect in semiconductors. Electrical and mechanical design of Photovoltaic cells, panels and systems. Use of lenses and mirrors in

PV systems. Manufacturing methods of PV devices. (3, 3+0L) Pre-requisites: EECE322, EECE371; Spring. Cross-listed with EECE572/472

ME574/474 MODELING, SIMULATION AND SYNTHESIS OF ELECTROMECHANICAL CONTROL SYSTEMS Computer aided simulation of dynamic systems and design of control systems, electrical machines, actuators and sensors; linearization techniques; scaling; performance criteria; robustness; state-space design; prototyping and bread-boarding techniques. Synthesis through hardware implementation of an electromechanical control system. (3, 3+0L) Pre-requisite: EECE203L and senior or graduate standing. Cross-listed with EECE574/474

ME583/483 STATISTICAL METHODS FOR IMPROVING PRODUCT DESIGN/QUALITY
Basic concepts of statistical inference and topics in reliability, acceptance criteria, statistical process control, full and fractional factorial experiments, and response surface methodology. The emphasis will be on the effective implementation of the techniques rather than their mathematical development. (3, 3+0L) Pre-requisite: MATH 162L and senior or graduate standing. Cross-listed with EECE583/483

ME586/486 DESIGN FOR MANUFACTURABILITY
Introduction to methods of design for manufacturability such as robust systems and design requirements, Taguchi methods, Kanban methodology, statistical control assembly and test.
 (3, 3+0L) Pre-requisite: MATH115 and senior or graduate standing. Cross-listed with EECE586/486

ME599/499 TOPICS IN ME – Assignment of a project for individual or team execution. Requirements, planning, research, implementation and recommendations or conclusions can form one or more of the phases of the project. (X, X+0L) – variable credits up to 3 hrs.

Appendix F
Other References

ASEE Prism (2005) *Re-engineering Engineering*, Sept. 2005, p. 16..

National Academy of Engineering (2005) *Educating the Engineer of 2020*, Washington, DC: The National Academies Press.

National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2005), *Rising Above the Gathering Storm – Energizing and Employing American for a Brighter Economic Future,* Washington DC: National Academies Press, Appendix D, p. 348.

National Center for Education Statistics (2006) Report and Suggestions from IPEDS Technical Review Panel No. 15 – First Professional Degree Classification, http://nces.ed.gov/ipeds/trp15a.asp.

Rehkugler, Gerald E. (1994) *TEMPUS Program- A Substantial Innovation in the Higher Education (Cornell University),* Session 1455, 1994 ASEE Annual Conference Proceedings, p. 444.

Appendix G
Guidelines Title 5 NMAC Chapter 5, Part 2

TITLE 5   POST-SECONDARY EDUCATION
CHAPTER 5 POST-SECONDARY EDUCATIONAL PROGRAMS
PART 2   APPROVAL OF NEW GRADUATE PROGRAMS

5.5.2.1   ISSUING AGENCY: New Mexico Higher Education Department
(NMHED).
[3/16/51, 7/1/94; 5.5.2.1 NMAC - Rn & A, 5 NMAC 5.2.1, 02/28/07]

5.5.2.2   STATUTORY AUTHORITY: The NMHED has statutory responsibility
to review new graduate programs proposed by state universities as part of its authority for
statewide planning and oversight of post-secondary education. The Post-Secondary
Educational Planning Act, specifically Section 21-2-5 NMSA 1978, authorizes the
NMHED to conduct statewide planning, including analyses of state needs for post-
secondary educational programs. Section 21-1-24 NMSA 1978 requires that any graduate
program that is to benefit from state funding must first be approved by the NMHED and
by the New Mexico state board of finance.
[4/5/71, 3/29/73; 5.5.2.2 NMAC - Rn & A, 5 NMAC 5.2.2, 02/28/07]

5.5.2.3   SCOPE: The provisions of 5.5.2 NMAC apply to any new graduate
program proposed for implementation by any constitutional institution of higher
education in New Mexico.
[2/26/85, 5/4/90, 9/30/97; 5.5.2.3 NMAC - Rn, 5 NMAC 5.2.3, 02/28/07]

5.5.2.4   DURATION: Permanent.
[9/30/97; 5.5.2.4 NMAC - Rn, 5 NMAC 5.2.4, 02/28/07]

5.5.2.5   EFFECTIVE DATE: September 30, 1997, unless a later date is cited at
the end of a section.
[9/30/97; 5.5.2.5 NMAC - Rn & A, 5 NMAC 5.2.5, 02/28/07]

5.5.2.6   OBJECTIVE: The objective of 5.5.2 NMAC is to provide an orderly,
objective basis for review and approval or disapproval of each new graduate program
proposed for implementation. Although this regulation is intended primarily to guide
decisions by the NMHED and its staff, it may also be used to guide review by the
institutions and by statewide councils of graduate deans and chief academic officers.
Decisions about new graduate program proposals shall be exercised so as to:
        A.   fulfill societal requirements, employer needs and student demand;
        B.   support high standards of academic quality;
        C.   encourage cooperation among institutions, public and private;
        D.   avoid unnecessary or inappropriate duplication; and
        E.   maximize cost effectiveness for the state.
[2/26/85, 5/4/90, 9/30/97; 5.5.2.6 NMAC - Rn & A, 5 NMAC 5.2.6, 02/28/07]

5.5.2.7   DEFINITIONS:
          A.   "Graduate program" is defined as any sequence of courses, activities or experiences which leads to award of any degree beyond the baccalaureate degree. Graduate programs subject to 5.5.2 NMAC include those leading to a master's degree, a doctoral degree, or a professional degree in fields such as law, medicine or other professions.
          B.   "New" graduate program is defined as one that differs from currently approved programs at the proposing institution, in terms of level of degree or area of study.
[2/26/85, 5/4/90, 9/30/97; 5.5.2.7 NMAC - Rn & A, 5 NMAC 5.2.7, 02/28/07]

5.5.2.8   GENERAL REQUIREMENT OF NMHED APPROVAL:
          A.   No graduate program established following the effective date of 5.5.2 NMAC, nor any student enrolled in that program, shall be eligible for inclusion in any of the NMHED's funding recommendations unless the program has been approved by the NMHED and by the New Mexico state board of finance.
          B.   In the case of a question of applicability of 5.5.2 NMAC to a particular change in graduate programming, the NMHED staff will consult with the NMHED review board, council of graduate deans, and the New Mexico academic council and will consider the advice of all groups in rendering a decision about applicability. Staff decisions may be appealed to the NMHED's cabinet secretary whose decision will be final.
          C.   Changes that require approval by the NMHED.
          (1)   Addition of a doctoral degree in an area in which a master's degree is already awarded, or the converse, is subject to the provisions of 5.5.2 NMAC.
          (2)   Any substantial change in an existing graduate degree program, which may or may not be reflected as a change in the title of the degree awarded, will be sumitted to the NMHED for review and may be required to undergo the process for approval of new graduate programs (5.5.2.10). Among the tests of substantial change will be (i) change in a curriculum impacting at least one-third of the courses, (ii) change reflecting a new program title in the institution's catalog, (iii) change which adds a distinct and separate course of study at the institution and/or (iv) change that may later change the classification of the proram in the institutions's inventory of instuctional programs.
                    (a)   Addition of a program option, concentration or specialization that will result in a new degree title being awarded will be submitted to the NMHED for review and may be subject to the provisions of 5.5.2 NMAC, but addition of another option, concentration or specialization to an existing approved program that would not change the title of the degree awarded does not require approval of the NMHED.
                    (b)   Proposed changes in the name of an existing program, option, concentration, emphasis, specialization, or number of credit hours, without other substantive change or questions of applicability of 5.5.2 NMAC should be referred to the NMHED for a staff determination of applicability and to assure that the NMHED's data base remains accurate.
          D.   Changes that do not require approval by the NMHED.

(1)   Revisions of the curriculum of a program, option, concentration or specialization that do not alter how the program, enrollments and degrees awarded are reported to the NMHED are not subject to the provisions of 5.5.2 NMAC.

(2)   Deletion of a program option, concentration or specialization within an existing graduate program is not subject to the provisions of 5.5.2 NMAC.

(3)   Reconfiguration of an existing program in a manner that will retain the title of an existing program and that will not result in a net gain in the number of programs offered by an institution, such as consolidation of two or more programs into a single program, is not subject to the provisions of 5.5.2 NMAC.

(4)   Change in the department responsible for a graduate program, without a substantial change in the curriculum of the program and without a corresponding change in the title of the degree awarded, is not subject to the provisions of 5.5.2 NMAC.

(5)   A program, option, concentration or specialization that has been prepared to meet a request of a particular employer and that will be financially supported by that employer is not subject to the provisions of 5.5.2 NMAC. However, such programs are considered restricted and do not receive state funding. Students enrolled in such programs are not eligible for any state support until the program is approved pursuant to 5.5.2 NMAC and the program becomes unrestricted.

(6)   Dormant programs. Dormant programs are graduate degree programs that have not admitted new graduate students for a period of three consecutive years. The institution of higher education must inform the NMHED about dormant programs each year and indicate whether or not the program of study will be deleted by the institution or revised to attract new graduate students. Programs can be dormant for a period of six years. Plans to revise degree programs that require changes in the type of degree awarded require approval by the NMHED.

(7)   Post-baccalaureate certificate of specialization.

E.   Post-baccalaureate certificate programs do not require the same level of review and approval as post-baccalaureate degree programs. The NMHED will need to approve programs that demonstrate financial need and require additional resources in the form of new funding, additional faculty or additional facilities. Certificate programs that do not require new resources and can be implemented with existing faculty, existing courses, and existing facilities can be approved internally as indicated below. A certificate of specialization is a program of study that is designed to develop or enhance a focused area of expertise. The primary purpose of certificate programs is to provide specific skill training and to enhance employability and quickly meet manpower needs within the state of New Mexico. Certificate programs can be offered to currently enrolled degree seeking students and students that meet the admissions criteria but that enroll solely to obtain a certificate in a given area of expertise.

F.   Concentrations or specializations differ from certificate programs in that they are designed to meet the needs of enrolled degree seeking students within the given institution of higher education.

G.   Certificate programs offered by institutions of higher education within the state of New Mexico must include at least 12 credit hours of course work that is interrelated and designed to develop a focused skill or area of expertise. Certificate programs cannot exceed 18 credit hours. Courses that comprise the certificate must be regular approved courses that are already offered by the institution.

H.	Certificate programs that do not require new resources and can be implemented with existing faculty, existing courses, and existing facilities can be approved internally by the appropriate mechanisms within the institution of higher education and the chief academic officer of that institution. Approved certificate programs must be registered with the NMHED within three months of approval. The registration process includes submitting a copy of the proprosal, a CIP code request, and a copy of the signature sheet documenting the approval process for the new certificate program.

I.	The NMHED will serve as a clearinghouse for information regarding degree and certificate programs offered in the state of New Mexico. A web-based listing of certificate programs posted on the NMHED website will allow potential students to obtain a comprehensive picture of educational opportunities within New Mexico.

J.	Internal proposals for new certificate programs should include information on the rationale for the certificate, evidence of need, statements on the ability to meet manpower needs within the state, enrollment projections, and an evaluation plan that indicates whether or not the needs of the state are being met.

K.	Certificate proposals that require new resources must develop a proposal for external approval by the New Mexico council of graduate deans, the academic council, the NMHED, and the New Mexico state board of finance, following the process for new degree proposals.

L.	Students enrolled in post-baccalaureate certificate programs must meet the same minimum admissions criteria as students admitted into graduate degree programs at the institution of higher education.

M.	Institutions of higher education must notify the NMHED immediately if a certificate program is discontinued.
[2/26/85, 5/4/90, 9/30/97; 5.5.2.8 NMAC - Rn & A, 5 NMAC 5.2.7 & 8, 02/28/07]

**5.5.2.9	REQUIREMENTS FOR APPROVED GRADUATE PROGRAMS:**
The requirements and questions listed below will be used in reviewing proposals to establish new graduate programs. The NMHED reserves the right to weigh these factors differentially and to consider additional factors in reaching decisions that best meet the interests of the state of New Mexico. These requirements are constructed to reflect state-level interests in post-secondary education; reviews of new graduate programs within the proposing institution are expected to reflect a somewhat different balance of concerns, for example, devoting greater consideration to details of program quality.

**A.	Purpose of the program and mission of the proposing institution.** The proposed program must have a clear purpose that is consistent with the mission of the proposing institution.

(1)	What is the primary purpose of the proposed program? What are its secondary purposes, if any?

(2)	Is the proposed program consistent with the role and scope of the institution as set forth in its mission statement and interpreted by its governing board?

(3)	What is the institution's priority for the proposed program, as indicated in its most recent plans, funding requests or other institutional documents?

(4)	What is the curriculum for the proposed program? What types of courses and other degree requirements are needed for degree completion? What types of

skills or competencies will students develop as a result of completing the degree prgoram?

      B.   Justification for the program. The proposed program must meet one or more specified needs within the state or region; must not duplicate existing programs unnecessarily or inappropriately; and, to the extent feasible and appropriate, should benefit from cooperative arrangements with other institutions.

          (1)   Need. The proposed program must meet one or more specified needs within the state or region. Clear and convincing evidence must be provided of the reality and extent of such need.

              (a)   Why is the program needed? Will graduates of the program help meet some specified state or regional workforce need? Have specific potential employers requested or expressed interest in, the program? What, if any, internal institutional needs will also be met by the program?

              (b)   Evidence of need might include results of employer surveys, current labor market analyses and projections, or long-term need projections prepared by a relevant professional organization. Summaries of student interest also are appropriate but will not by themselves be considered sufficient evidence of need.

              (c)   Although academic and research interests of institutional faculty may be met through implementation of the proposed program, such interests by themselves are unlikely to persuade the NMHED of need for the program. However, institutions of higher education may build programs around their areas of excellence. A clear demonstration of such excellence is expected in the proposal.

          (2)   Duplication. The proposed program must not duplicate existing programs unnecessarily or inappropriately. A proposal for a program similar to one (or more) that already exists within the state must present clear and convincing evidence that need for the program cannot be met by the existing program(s).

              (a)   Is this program, or are similar programs, offered at any other public or private institutions within New Mexico?

              (b)   If so, what is the remaining capacity of the program(s)? How many students could the existing program(s) accommodate without additional resources for faculty, equipment, facilities and other needs?

              (c)   In light of the above information, why should the proposed program also be approved? What programmatic, geographic or other factors warrant approval of the program as an addition to the existing educational resources in the state?

              (d)   Do New Mexico students have access to a comparable program in another state through either the WICHE professional student exchange or the WICHE regional graduate program?

              (e)   As evidence, the proposing institution must assemble and display data listing each similar program offered by regionally accredited public and private universities in New Mexico; the numbers of students admitted to each of those programs during each of three recent, consecutive years; the numbers of degrees/ certificates awarded during each of those years; and each university's estimated remaining capacity of its program(s).

              (f)   To the extent feasible and appropriate, statements from representatives of the existing programs should be attached to the proposal, articulating their positions with regard to the proposed program.

(g)   The purpose of this requirement is twofold: (i) to assure that communication has taken place with existing programs, as an element in planning the proposed program, and (ii) to aid reviewers in assuring that there is need for the program that cannot be met through existing programs.

(3)   Inter-institutional collaboration and cooperation. The NMHED strongly encourages collaborative relationships with other programs within New Mexico, so that state investments can be shared and students can benefit from expanded opportunities across institutional boundaries.

(a)   Are there programs at other institutions, and particularly programs already supported by the state, through which shared instruction, collaboration with faculty or other means of broadening student options and experiences can be arranged as part of the proposed program?

(b)   If the proposed program is related to other programs operating at public institutions in the state, the proposal should document how collaboration will be achieved with those programs. For example, if it is feasible and productive to share faculty, instruction or other assets with an existing program at another institution, the proposal should outline how that collaboration will take place. If other arrangements for expanding students' experiences can be made with other institutions, those arrangements should be summarized.

C.   Clientele and projected enrollment. The proposal must clearly describe the population of students who will be recruited for the proposed program and must include a detailed projection of enrollment and credit hours anticipated during the first five years.

(1)   Clientele.

(a)   Who are the students to be served by the proposed program? Will the program concentrate its recruitment upon students representing some particular geographic area, students from some special employment sector or some other identified group?

(b)   What academic or experiential qualifications will be set for admission?

(c)   Will the proposed program be consistent with state goals for equitable representation of all students? How will the program assure equal access and success of students from groups historically underrepresented in graduate education or in the fields of employment for which the program is intended to prepare its graduates?

(i)   At a minimum, the proposal should include data illustrating the representation of diversity in ethnic and sex/gender groups of (a) undergraduate students and (b) graduate students at the proposing institution and should articulate the methods that will be used to assure equity in access and success in the proposed program.

(ii)   To the extent possible, the proposal also should include information about representation in the fields of employment for which the program is intended to prepare students and other information relevant to assessing the capacity of the program to help redress underrepresentation.

(2)   Projected enrollment.

(a)   The proposal must display, in clear tabular form, the projected enrollment in the proposed program during its first five years. This presentation must

distinguish the number of new students (headcount) expected to enroll each year, the number of returning students expected to re-enroll in each year, and the methodology used to arrive at those projects.

        (b)   The proposal should indicate the number of students expected to enroll full-time and the number expected to enroll on a part-time basis and must display the total number of student credit hours expected to be generated in each of the first five years.

        D.   **Institutional readiness for the program.** The institution should have nearly all of the resources needed to initiate the program. The proposal should include a clear statement of the extent to which the institution is ready to initiate the program, citing the remaining needs and recognizing each of those needs in the cost analysis developed pursuant to Subsection E of 5.5.2.9 NMAC.

        (1)   Is the teaching faculty adequate in number and qualifications to initiate the program? If not, what additional faculty are needed? To what extent will the program rely upon graduate assistants to free faculty time for graduate instruction in the proposed program?

        (2)   Are the library and other academic support resources sufficient to initiate the program? If not, what additional resources are needed?

        (3)   Are the physical facilities of the institution adequate for the first five years of the program? Will additional space or modifications of existing space be required within the first five years of program operation?

        (4)   Are the institution's equipment and technological resources adequate for the first five years of the program? What, if any, additional equipment will be needed?

        (5)   Are other operating resources adequate to initiate the program? For example, will additional clerical or specialized personnel be needed?

        (6)   Are there existing external facilities that will be used? Have agreements been established to ensure use of those facilities? For example, if you are offering a nursing or allied health program have you established a partnership with local hospital(s) and other clinical settings?

        E.   **Projected cost of the program.** The proposal must include a clear analysis of the projected cost of the proposed program and the sources of funding that will support it.

        (1)   New costs for program start-up. The proposal should provide a clear indication of new costs that must be met in order to begin the program and to sustain it during its first five years. The analysis must address at least the following cost categories:

        (a)   Additional faculty needed for the program, full-time and part-time.

        (b)   Additional library resources needed for the program. The proposal should include a statement from the university librarian, indicating the cost of these new resources and the schedule on which the resources will be provided.

        (c)   Additional facilities, equipment and technological resources needed for the program.

        (d)   New graduate assistantships needed to support the program, including the dollar value of the assistantships during each of the first five years of the program.

(2)	State support. An analysis must be presented showing the approximate amount of state operational formula funding that will flow to the program for each of the first five years, based upon the projected student credit hours and current formula funding factors, and recognizing the delay and averaging characteristic of the formula.

(3)	Other support. If the proposed program will benefit from other sources of operational support, the proposal should describe those. For example, if particular cost categories such as new equipment or additional graduate assistantships are expected to be supported by research grants, contracts or other sources, the proposal should clearly describe those sources and levels of support and should indicate the advantage to the state of receiving such support.

**F.	Quality of the program.** The proposed program must be designed to meet high standards of academic quality, considering its instructional curriculum, faculty, student admission standards, opportunities for experiential learning and academic support, and provisions for continual review and improvement of the program.

(1)	All programs supported by state funds are expected to comply with principles of academic quality delineated as part of the NMHED's regulation on instructional funding: 5.3.12 NMAC.

(2)	Among the questions that will be considered in evaluating proposals for new graduate programs are the following:

(a)	Is the curriculum adequately structured to meet the stated purposes of the program?

(b)	Is the faculty adequate in number, experience and availability to offer a high quality program?

(c)	How do the proposed academic admission standards for students entering the program compare with standards for other programs at the institution and with admission standards for comparable programs at other institutions in New Mexico or other states?

(d)	How will the proposed program utilize current technologies to support program quality and delivery?

(e)	What opportunities will be available for assisting students to gain experiences relevant to work settings for which the program will prepare them?

(f)	What academic support services are available to students, to assist them in succeeding in the program?

(g)	What final integrating experiences or other features will be used to assure that graduates have acquired the knowledge and skills expected for the degree or certificate awarded?

(h)	Has the proposed program been evaluated by any external reviewers or is there other external evidence or opinion regarding the quality of the program?

(i)	When will the new program be proposed for accreditation by the higher learning commission of the north central association?

(j)	Will specialized accreditation be sought for the program? If so, when?

**G.	Assessment of operations and impact.** The proposal must include a plan by which the proposed program will be assessed for its operation and impact over at least a five-year period.

(1)   At a minimum, the plan must indicate methods that will be used to monitor program operations, progress of students and program completion rates.

(2)   The plan also must include methods for obtaining evaluations from students, graduates or other appropriate sources and feeding that information into future operation of the program.

H.   Administrative responsibility for the program and institutional commitment. There must be clear indication in the proposal that the institution is committed to the success of the proposed program.

(1)   The proposal should indicate where in the structure of the institution the program will be administered. For example, which department will have primary responsibility and which additional departments, if any, will contribute to operation of the program?

(2)   The proposal should include a clear statement of administrative support for the program, sufficient to assure that resources will be provided during the first five years of the program. The proposal should also verify that all within-institution approvals needed for the program have been granted, including approval by the institution's governing board.

[2/26/85, 5/4/90, 9/30/97; 5.5.2.9 NMAC - Rn & A, 5 NMAC 5.2.9, 02/28/07]

5.5.2.10   PROCESS FOR APPROVAL OF NEW GRADUATE PROGRAMS:

A.   Before submitting a proposal for review by the NMHED, an institution must have completed all internal institutional reviews required for new graduate programs. The proposal must be in a form that is fully supported by the institution.

B.   Advance notice to the NMHED staff of the intent to submit a proposal for a new graduate program is required, as it will assist in planning and will create a more efficient review process. A proposal should be submitted to the NMHED and the council of graduate deans at least nine months prior to the anticipated date of implementation of the program, in order to allow sufficient time for review by the council of graduate deans, the academic council, the NMHED review board and the New Mexico state board of finance prior to implementation. Programs cannot be included in institutional catalogs until they have been approved.

C.   The proposal may be submitted simultaneously to the NMHED and to the council of graduate deans. The NMHED staff will begin an independent review of the proposal and will follow the proposal through the review process with the council of graduate deans and the academic council. Members of the council may solicit input on the proposal from cognizant members of their faculty, for inclusion in the council's consideration. As it deems appropriate, the council may suggest modifications of the proposal or the proposed program.

D.   If the council of graduate deans finds that the proposed program warrants further consideration, it will forward its written recommendation and comments to the academic council on higher education (the chief academic officers of the state universities) and to the NMHED. A proposal considered but not recommended by the council of graduate deans may be forwarded by the sponsoring institution directly to the academic council.

E.   The academic council will conduct its review of the proposal and may suggest modifications of the proposal or the proposed program. The NMHED staff will participate in the review by the academic council.

F.   When the academic council has completed its review of the proposed program, it will notify the NMHED that the proposal is ready for consideration by the NMHED. The council will forward to the NMHED its written comments regarding the proposed program.

G.   Following notification by the academic council, the proposal will be subjected to independent review by the NMHED staff. The NMHED staff may request additional information from the institution for use in its review. Based upon the outcome of its review, staff will submit a written recommendation to the NMHED review board indicating either (1) that the proposal satisfies the requirements set forth in this regulation and that the NMHED recommends approval of the program; or (2) that staff recommend denial of the proposal. Information supporting the decision to deny the proposal will be included.

H.   Following completion of the staff review, the proposal and staff recommendation will be considered by the NMHED review board. The proposal and staff recommendation will be presented as an approval item at the next NMHED review board meeting. The NMHED may elect to return a proposal to the sponsoring institution, for modification, or to the council of graduate deans, the academic council, or both, for reconsideration. At any point during the review process, the sponsoring institution may withdraw its proposal.

I.   If the NMHED review board approves the proposed program, the NMHED staff will submit the proposal or an appropriate summary of the proposal, along with the council of graduate deans, the academic council's, the NMHED review board's, and the NMHED's recommendations, to the New Mexico state board of finance. The NMHED staff will notify the institution of the date when the New Mexico state board of finance has scheduled its consideration of the proposal.

J.   The NMHED staff will present a summary of the proposed program along with the recommendation of the NMHED to the New Mexico state board of finance. Institution personnel will be expected to be present to answer questions, present additional information or provide justification of the proposal to the New Mexico state board of finance. The role of the NMHED staff will be to present the recommendation of the NMHED to the board.
[9/30/97; 5.5.2.10 NMAC - Rn & A, 5 NMAC 5.2.10, 02/28/07]

HISTORY OF 5.5.2 NMAC:
Pre-NMAC History: The material in this part was derived from that previously filed with the State Records Center and Archives under:
BEF Rule 210, Graduate Programs - Approval of New, 2/26/85.
CHE Rule 210, Graduate Programs - Approval of New, 5/4/90.