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Research Internships in Science and Engineering

Research Interns in Science and Engineering (RISE)
Summer 2002 - Student Projects

Student Major / School	Mentor	Faculty Sponsor	Department	Student Project
Brandon Barnes Electrical & Computer Engineering UCSB	Jon Geske	John Bowers	Electrical & Computer Engineering	Optically pumped VCELS
Andrea Burbank Engineering Stanford	Paul Forster	Anthony Cheetham	Materials	New open-framework metal carboxylates
Jon Clements Chemical Engineering UCSB	Ashutosh Gandhi	Carlos Levi	Materials	Study of the evolution of metastable phases in chemically synthesized YIG and YAG systems
Eric Feinstein Biochemistry UCSB	Jason Sagert	Herbert Waite	Molecular, Cellular & Developmental Biology	Mechanical property analysis of mussel byssal threads
Nate Freund Biochemistry UCSB	Enrico Bellomo Andy Nowak	Tim Deming	Materials	Thermal responsive polymers/polypeptide based nanocomposites
Maykel Ghorbanzadeh Electrical Engineering UCSB	Brendan Moran Tal Margalith	Steven Denbaars	Electrical & Computer Engineering	GaN LEDS and LASTERS for solid-state lighting and displays
Jeffrey Katrencik Bioengineering & Finance University of Pennsylvania	Joy Schramm	Samir Mitragotri	Chem Engineering	Investigation SSKIN failure mechanisms by jet injection
Alan Kleiman Chemical Engineering	Tom F.	Eric	Chemical	Combinatorical electrochemical synthesis

Universidad Nacional Autonoma de Mexico	Jaramillo	McFarland	Engineering	of Cobalt-based mixed metal oxides for hydrogen production
Lily Lee Chemical Engineering UCSB	Tim Alig	Joe Zasadzinski	Chemical Engineering	Study of lung surfactant recovery
Nicole Lemaster Physics UCSB	Miikkas Kangas	Phil Lubin	Physics	Corrugated 90-GHZ platelet horn array
Tammy Luoh Bichemistry Univerisy of Oregon	Heather Evans	Cyrus Safinya	Materials	Effect of serum on gene delivery via cationic lipid
Pawel Majewski Chemistry Prince Josef Poniatowski Poland	Brian Naughton	David Clarke	Materials	Synthesis and characterization of magnetic GD_2O_3 particles
An Ngo Chemical Engineering University of Pittsburg	Heidi Warriner	Joe Zasadzinski	Chemical Engineering	Collapse structures of lung surfactent phospholipid
Kiran Pallegadda Electrical Engineering & Finance University of Pennsylvania	Jeff Henness	Larry Coldren	Electrical & Computer Engineering	Integrated INP optoelectronic wavelength converter
Ryan Palmer Physics & Math California Lutheran University	Michael Messina	Petar Kokotovic	CCEC	Cart and inverted pendulum system
Kortney N. Pinkney Mechanical Engineering North Caolina A&T Univeristy		Glenn Beltz	Mechanical and Environmental Engineering	Use of finite element method to model bending of ceramic composites
Gurminder Sangha Electrical	Jon		Electrical &	MOCVD monitor and

Engineering California State University Fresno	Burnsed	Roy Smith	Computer Engineering	process control
Justin Scott Mechanical Engineering UCSB	Lori Callaghan	Noel MacDonald	Mechanical Engineering	Scream MEMS
Ethan Sundilson Geography UCSB		Donald Janelle Michael Goodchild	Geography	CIS/Spatial analysis "Cookbook" for the social sciences
Carlin Wong Geography UCSB		Donald Janelle Michael Goodchild	Geography	Arcview and arcinfo cookbook
Zuag Yang Biology UCSB	Paul Forster	Anthony Cheetham	Materials	Exploratory synthesis of transition metals with monocarboxylates
Sam Ying Geography UCSB		Donald Janelle Michael Goodchild	Geography	Applying geographic inforamtion system methodologies to social sciences

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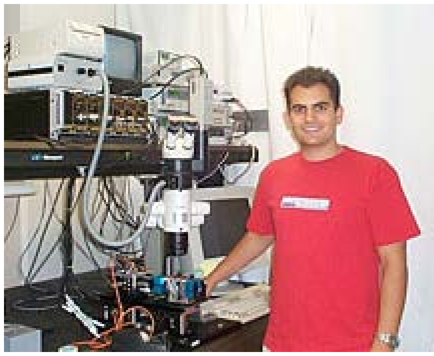
Brandon's Project Page



Intern:Brandon Barnes
Mentor:Jon Geske
Faculty Supervisor: Dr. John Bowers
Department: Electrical & Computer Engineering

OPTICALLY PUMPED VCSELS

In recent time the vertical-cavity surface-emitting laser (VCSEL) has been a vigorous area of semiconductor laser research. VCSELs have proven to have manufacturing, packaging, and performance advantages over their predecessor, the edge-emitting laser. In recent years VCSELs operating at or near 1.3ƒÝm and 1.55ƒÝm have been the subject of intense research. One popular method of testing these long-wavelength VCSELs is to optically pump the VCSEL with another laser to create the stimulated emission. Despite the processing and testing benefits associated with optical pumping, problems with this testing technique exist. The time required to locate and align the lasers for testing is far too great. It is also difficult to maintain the alignment due to temperature drift in the stage position. Since the optimum alignment between the pump laser beam and the VCSEL device is required for optimum performance, the user has been required to manually align the device by monitoring the VCSEL¡¦s output. This very time consuming and tedious process has proven to substantially hinder the progress of the VCSEL research. My project involved programming a new motorized X-Y-Z stage and designing a building a new thermally controlled testing platform. This new setup will perform advanced search algorithms to locate and focus in on a device with a touch of a button. The setup will also allow the user to save device locations so that they can be returned to later. The new thermal design will also limit the problems associated with stage movement by the expanding and contracting of stage components. With the setup near completion, it is proving to be very promising in reducing the time required to test an optically pumped VCSEL.

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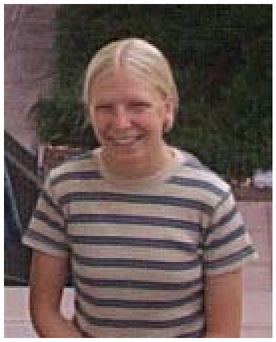
Andrea's Project Page



Intern: Andrea Burbank, Stanford
Mentor: Paul Forster
Faculty Supervisor: Dr. A.K. Cheetham
Department: Materials

NEW OPEN-FRAMEWORK METAL CARBOXYLATES

The synthesis and characterization of open-framework materials with pores up to a nanometer in diameter constitute a quickly developing field in chemistry, due to these materials' interesting structures and their potential applications in ion exchange, catalysis, and separations. Newly synthesized materials with high porosities could complement the current use of porous compounds in applications as diverse as water softeners and catalytic converters with new functions: pores used to store hydrogen in fuel cells or catalyze a variety of chemical reactions, for example. Metal carboxylates are among the classes of compounds currently being explored for their capability to form multi-dimensional frameworks that typically join metal ion centers via organic carboxylate bridges to create a hybrid inorganic/organic material with interesting chemical properties. My work has focused on exploring new synthetic methods and determining crystal structures of new metal carboxylates, including copper adipate, iron glutarate, cobalt succinate, cobalt 1,3,5-benzenetricarboxylate, and various other transition metal-based hybrid materials. Though all based on the same starting principle of bridging carboxylates, each of these exhibits remarkably different chemistry, from one-dimensional chains to two-dimensional sheets connected in discrete layers by metal centers and organic linkages. Development and analysis of these materials provide not only an interesting window into nanochemistry but also the potential for novel applications of the pores, channels, and chains that these compounds display.

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Jon's Project Page

Intern: Jon Clements, UCSB
Mentor: Dr. Ashutosh Gandhi
Faculty Supervisor: Dr. Carlos Levi
Department: Materials

STUDY OF THE EVOLUTION OF METASTABLE PHASES IN CHEMICALLY SYNTHESIZED Al_2O_3-Y_2O_3 AND Fe_2O_3-Y_2O_3 SYSTEMS

Metastable ceramic processing is a field of study that seeks to refine the desirable properties of ordinary ceramics by introducing metastability. If a system is in a metastable state, it is not at equilibrium and must overcome a thermodynamic barrier in order to reach the equilibrium state. Also, such materials are often nanocrystalline. Methods of non–equilibrium processing include rapid solidification processing, physical vapor deposition and chemical synthesis. Systems such as Yttrium Aluminum Garnet ($Y_3Al_5O_{12}$, YAG) and Yttrium Iron Garnet ($Y_3Fe_5O_{12}$, YIG), which have promising ceramic applications, have a tendency to form metastable phases under conditions which kinetically suppress the formation of the stable state. Using chemical synthesis, it is possible to produce metastable phases of YIG and YAG systems that can be quantitatively and qualitatively analyzed using X-ray diffraction (XRD). I was involved in using modified precursor spray pyrolysis, a method of chemical synthesis, to obtain homogeneous amorphous phases in the Al_2O_3-Y_2O_3 and Fe_2O_3-Y_2O_3 systems around the garnet composition. Homogeneity of the amorphous phase is necessary to ensure that we are studying the desired composition. If segregation is present, the composition can vary throughout the sample, making any formal analysis impossible. Having used precursor spray pyrolysis, upquenching and XRD, we concluded that precursor spray pyrolysis produces homogeneous amorphous phases for the Al_2O_3-Y_2O_3 system. However, for the Fe_2O_3-Y_2O_3 system we explored another method of chemical synthesis (co-precipitation) in order to produce a homogeneous amorphous phase. By finding homogeneity in the amorphous phase of Al_2O_3-Y_2O_3, it will be possible to study the phase evolution of the amorphous phase into the metastable phase.

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Eric's Project Page

Intern: Eric Feinstein, UCSB
Mentor: Jason Saggert
Faculty Supervisor: Dr. Herbert Waite
Department: Molecular, Cellular and Developmental Biology

MECHANICAL PROPERTY ANALYSIS OF MUSSEL BYSSAL THREADS

Mussel byssal threads possess many properties which allow the mussels that make them to meet the challenges faced in the rocky intertidal zones they inhabit. Byssal threads are simple morphologically, rapidly reproducible and present tremendous industrial potential due to mechanical behavior determined by chemical and physical structure. I was involved in the refinement and application of methods and procedures designed to investigate the tensile properties of byssal threads, from arranging mussels in aquatic tanks to foster the production of threads to the mounting of threads while minimizing slippage under testing conditions so as to obtain accurate readings. The primary equipment used in this research is the Materials Testing Software (MTS) Bionix 200, a sensitive load-cell based instrument that is made by Materials Testing Software Corporation (Minneapolis, MN) and is related to instrumentation used in the automotive and aerospace industries. The tester's specialized software package, along with customized methods (macros), was used to perform data analysis. This research will help with our larger project of better understanding the biochemistry behind the threads.

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Nate's Project Page

Intern: Nate Freund, UCSB
Mentor: Enrico Bellomo, Andy Nowak
Faculty Supervisor: Dr. Tim Deming
Department: Materials

THERMAL RESPONSIVE POLYMERS / POLYPEPTIDE BASED NANOCOMPOSITES

Thermal responsive materials have shown promise in a number of engineering and medical applications. When using such materials in biological environments temperature dependency is directly related to functionality. The goal of this research is to modify the side groups of Poly(ƒ×-benzyl-L-glutamate) as temperature controlled physical properties of biomaterials is a popular area of interest. The unique characteristic that is sought after is Lower Critical Solution Temperature. By controlling the amount of hydrophobicity (by addition of primary amines) that exists in concert with the remaining deprotected hydrophilic side chains, an LCST transition between room and body temperature can be achieved. For future applications, this would allow for a new and unique way to transport intravenously solid phase materials to the body while the material remains liquid until contact with body temperature. The second project this summer is a collaborative effort where we are studying polypeptide-based nanocomposites via solution-intercalating film casting technique. This technique involves the addition of polypeptides as reinforcements in between layers of clay montmorillonite that are used as the foundation for this type of nanocomposite. By adding poly(L-lysine) the nanocomposite gained increased storage modulus and mechanical strength. Adding polypeptides of different conformation and composition should give the nanocomposites new and exciting properties from what was already discovered. The primary focus is to synthesize copolymers and block copolymers of lysine/leucine, lysine/valine, L/D-lysine as well as others to see what effects secondary structure has on the properties of polypeptide/clay nanocomposites. Such polypeptide-based nanocomposites have potential commercial value and biomedical applications such as sutures, drug delivery matrices, load bearing implants, and other replacement biomaterials within the body.

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Maykel's Project Page

Intern: Maykel Ghorbanzadeh, UCSB
Mentor: Bremdam Faculty Supervisor: Dr. Steven Denbaars
Department: Electrical and Computer Engineering/Materials

GaN LEDS AND LASERS FOR SOLID-STATE LIGHTING AND DISPLAYS

Solid-State is innovative field in opto-electronics, which will help us to make a great deal of improvement to existing technologies that we use on a daily basis. Large Information displays, DVD and CD burners, car head and taillights, fiber communication are some examples for the application of GaN LEDs and Lasers. This summer my contribution to the group that I was working with was to work on couple of projects. One of these included designing and fabricating interior lighting (reading light for example) by using GaN LEDs. The second project was to understand the use of fluorescence light for night fishing and tries to mimic the same results with solid-state light. These projects are to be used as demonstration models in solid state and lighting display center at UCSB. The benefits of using solid-state lights are 85-90% electricity saving, 5‡10 yrs longer life span (durability) and Maintenance Savings. I was also partially involved in the MOCVD (Metal organic chemical vapor deposition) lab monitoring my mentors and learning how to operate the machines and the techniques of growing samples. There excites a great deal of improvement in this field (improving the growing techniques to reduce dislocations in GaN, which allows for better efficiency use of the devices). This was a once in lifetime experience. It was very exciting to be involved with on of the top research groups at UCSB and be working in a professional environment.

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MATERIALS RESEARCH LABORATORY at UCSB: an NSF MRSEC
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Jeff's Project Page

Intern:Jeff Katrencik, University of Pennsylvania
Mentor: Joy Schramm
Faculty Supervisor: Dr. Samir Mitragotri
Department: Chemical Engineering

INVESTIGATION OF SKIN FAILURE MECHANISMS BY JET INJECTION

Jet injections were introduced in the 1940's for use in mass inoculations and in the home. Despite the device's advantage of having no needles, the use of the traditional hypodermic needle has dominated the marketplace. Since little is known about the mechanisms of skin penetration and drug dispersion with jet injections, the goal of my research was to develop models for these characteristics. To do so, we jet injected Sulforhodamine B dye into clear polyacrylamide gels in order to obtain characteristics of the jet injection, such as the dispersion dimensions of the dye in the gel, the hole depth created by the jet, and rate of hole depth into the gel. The general shape of the dispersion is circular with an introductory channel. As the Young's modulus of the gel increases, the shape of the dispersion is truncated. The total penetration of the jet into the gel is a function of time and mechanical properties, as well as of velocity and radius of the jet. We present a mathematical model for the hole depth in polyacrylamide gels as a function of Young's modulus of the injected gel and elapsed time of injection. These models will be used to predict the mathematical model of a jet injection in skin.

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Alan's Project Page

Intern: Alan Kleiman, Universidad Nacional Autonoma de Mexico
Mentor: Tom Jamarillo
Faculty Supervisor: Dr. Eric W. McFarland
Department: Chemical Engineering

COMBINATORIAL ELECTROCHEMICAL SYNTHESIS OF COBALT- BASED MIXED METAL OXIDES FOR HYDROGEN PRODUCTION

The concept of using solar energy to split water into hydrogen and oxygen (photo electrolysis) is quite promising. For decades researchers have developed semiconductor materials that have specific properties for this task. Due to the complexities of photoelectrochemical heterogeneous catalysis, advancement in this area has been slow. Using a combinatorial chemistry approach for the electrochemical synthesis of these materials will expedite the production of materials and discover optimal combinations application. Cobalt-based mixed metal oxides have been explored and show promise in this endeavor.

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Lily's Project Page

Intern: Lily Lee, UCSB
Mentor: Tim Alig
Faculty Supervisor: Dr. Joe Zasadzinski
Department: Chemical Engineering

STUDY OF LUNG SURFACTANT RECOVERY

A lung surfactant lines the inside of our lungs and prevents collapse of the alveoli sacks when we breathe. Some premature babies are born without a lung surfactant and therefore do not survive. We are using a Langmuir trough to measure the collapse and recovery of phospholipids. We also utilize an Atomic Force Microscope (AFM) to image the collapse structures of these phospholipids. We have seen that the recovery improves with a decrease in the debye length. Also, from AFM images, we can say that in the absence of salt there is material in the subphase that is not attached to the monolayer. In the presence of salt we see vesicles ejected into the subphase. This information will help contribute to future advances in the study of lung surfactants.

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Nicole's Project Page

Intern: Nicole Lemaster, UCSB
Mentor: Miikkas Kangas
Faculty Supervisor: Dr. Phil Lubin
Department: Physics

CORRUGATED 90-GHZ PLATELET HORN ARRAY

Feedhorns direct energy from free space onto our detectors. Corrugated horns have tighter beam patterns, reduced sidelobes, and lower losses and polarization crosstalk than smooth-walled horns, but are harder to fabricate because of the need for more difficult machining and electroforming processes. Corrugated horns can also be manufactured in platelet arrays, with tilts built into the horns by offsetting the plate layers. It is possible to manufacture arrays of horns inexpensively by machining the plates individually and stacking them together. No diffusion bonding or gold plating has been necessary to achieve performance comparable to electroformed gold-plated silver corrugated horns from unplated cartridge brass shim stock and sheet metal. These tilted platelet horns have unusual beam patterns where the exit main lobe angle is empirically about 5/8ths of the tilt of the platelet horn with an 8 degree tilt in the platelet horn. The sidelobes are also affected a bit, with the secondary lobes moving in unison with resect to the main lobe and the one that moves closer to the main lobe being amplified and the one moving away from the main lobe being suppressed. This is in the coordinate frame of the main lobe. This may be important to experiments attempting to measure polarized signals like CMB polarization experiments.

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Tammy's Project Page

Intern: Tammy Luoh, University of Oregon
Mentor: Heather Evans
Faculty Supervisor: Dr. Cyrus Safinya
Department: Materials

EFFECT OF SERUM ON GENE DELIVERY VIA CATIONIC LIPID

Gene therapy is a medical process of replacing defective genes with functional genes. Non--viral based gene therapy, such as cationic lipid based gene delivery, offers low toxicity compared to viral delivery which typically elicits a directed immune response. The purpose of this study is to find an optimum gene carrier for gene therapy. A cationic lipid, a synthetic DNA carrier that interacts strongly with negatively charged DNA, delivers DNA by electrostatic interactions with anionic cell membranes. However, serum with polyanionic components in the blood stream hinders the delivery of DNA in vivo, lowering the transfection efficiency (the efficiency of transferring and expressing extracellular DNA). The cationic lipid, dioleoyl trimethylammonium propane (DOTAP), was neutralized with helper lipids, dioleyl phosphatidy choline (DOPC) or cholesterol to form liposomes with different charge densities. Using luciferase protein assay and optical microscopy, the effect of serum was shown decreasing as the charge density of the cationic lipid-DNA complex decreases. Pure DOTAP with high positive charge in the presence of 50% serum has a very low transfection efficiency, and small lipid-DNA complexes were shown under the microscope.

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Pawel's Project Page

Intern: Pawel Majewski, Prince Josef Poniatowski, Poland
Mentor: Brian Naughton
Faculty Supervisor: Dr. David Clarke
Department: Materials

MAGNETIC Gd_2O_3 NANO-PARTICLES SYNTHESIS AND CHARACTERIZATION

Following the route from the atomic scale where quantum mechanics is applied to the macroscopic scale where classical physics or chemistry rules, we go through a “nanoworld”; an area where we can find new and enhanced material properties such as magnetic permeability not found in either the atomic or macro scale. A technique named reverse micelle used in this research allows for the synthesis of very small magnetic gadolinium oxide crystals. The size of crystals obtained with this method varies from 10 to 250 nm in diameter. One goal of the project was to develop a synthesis procedure to give a satisfying yield as well as good cleanliness of obtained crystals. Once met, the next goal was to characterize the particles using different techniques: x-ray diffraction (XRD), transmission electron microscopy (TEM), thermogravimetric analysis (TGA), dynamic light scattering (DLS) and photoluminescence (PL). The information from these techniques will help draw a connection between synthesis procedure and final material properties. As a result his project will help to expand the knowledge and understanding of nano-scale material structure and properties.

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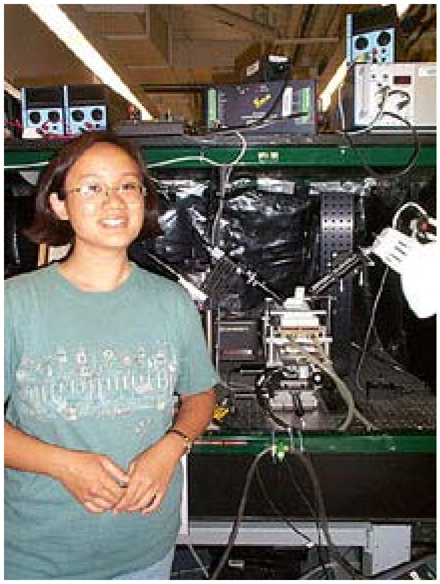
An's Project Page



Intern: An Ngo, University of Pittsburg
Mentor: Dr. Heidi Warriner
Faculty Supervisor: Dr. Joe Zasadzinski
Department: Chemical Engineering

COLLAPSE STRUCTURES OF LUNG SURFACTANT PHOSPHOLIPID

Lung surfactant (LS) is a mixture of lipids and proteins that forms a monolayer coating the alveoli of the lungs. During exhalation, LS is in the "collapsed" phase, forming three-dimensional multilayers or folded structures, and reducing the surface tension of the alveolar surface to its lowest point (zero). This decrease in surface tension prevents the alveoli from collapsing and reduces the work needed for reinflation. The structure of the LS layer at collapse determines its ability to respread, upon inhalation, to repeat the process. Collapse structures of DPPG, a lipid component of LS, were investigated with Brewster angle microscopy (BAM) and fluorescence microscopy (FM). The DPPG was spread on a layer of water and compressed with a Langmuir trough to mimic the expansion and compression of the alveolar surface during breathing. Surface pressure (the amount by which surface tension is lowered) was measured using a Wilhelmy plate attached to a pressure sensor made by R & K. It appears that the DPPG forms collapse induced fractures that do not respread upon reexpansion. Previous FM investigations suggest that the addition of surfactant protein SP-B facilitates respreading by allowing the DPPG monolayer to remain more fluid during collapse. Further studies seek to elucidate the role of SP-B by imaging with BAM.

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Kiran's Project Page

Intern:Kiran Pallegadda, University of Pennsylvania
Mentor: Jeff Henness
Faculty Supervisor: Dr. Larry Coldren
Department: Electrical & Computer Engineering

MODELING DRIVE CIRCUITRY FOR AN INTEGRATED InP OPTOELECTRONIC WAVELENGTH CONVERTER

This project involves modeling the drive circuitry of an an integrated optoelectronic (OE) wavelength converter. The single-chip device will contain a semiconductor optical amplifier (SOA) in line with a photodiode to handle the optical-to-electronic (O/E) conversion. The electrical signal will drive an electro-absorption modulator (EAM) to modulate the output of the sampled-grating distributed bragg reflector (SGDBR) laser and send out an optical signal. In the first phase of the work, various designs of the RF device circuitry were modeled in order to determine the electrical bandwidth of each design. Simulated results yielded a reasonable bandwidth range (2.5-4 Gb/s), but the drive voltage swing was too narrow. The possible solution investigated here was to integrate a heterojunction bipolar transistor (HBT) onto the chip for increased current gain. The device design goal was an HBT with an fT of 100 GHz. The design and modeling effort tailored an initial epitaxial layer structure and also calculated parameter values that would achieve the required fT frequency during simulation.

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Ryan's Project Page

Intern: Ryan Palmer, California Lutheran University
Mentor: Michael Messina
Faculty Supervisor: Dr. Petar Kokotovic
Department: Center for Control Engineering and Computation (CCEC)

CART AND INVERTED PENDULUM SYSTEM

The purpose of this project was to learn basic control techniques that can be applied to various systems such as Anti-Aircraft guns, cruise control, automotive suspension, remote control cars and helper robots (robots for disabled people). The specific plant used for this project was the classical inverted pendulum on a cart. The project involves designing a system that moves the cart back and forth in on dimension causing the pendulum to swing up from a relaxed state and into a balanced upright position. The cart sends back data about the pendulum's angle and position of the cart. Feedback is used to stabilize the system at the desired equilibrium point. The systems are created on MATLAB Simulink then implemented on a Quanser Consulting Inverted Pendulum setup. Using PID controllers I have been able to cause the system to swing up the pendulum and stabilize its upper equilibrium point while keeping the cart stationary. PID is a basic controller that can help understand the effects of control on system properties such as rise time and steady state error. This research will help me be able to work on more complex systems and solve tougher control problems in the future.

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Kortney's Project Page

Intern: Kortney Pinkney, North Carolina A & T University
Faculty Supervisor: Dr. Glen Beltz
Department: Mechanical Engineering

USE OF FINITE ELEMENT METHOD TO MODEL BENDING OF CERAMIC COMPOSITES

Ceramic composites are a relatively new form of material that is being tested and improved upon to soon be used in place of typical building materials. Ceramic composites are composed of ceramic particles and ceramic fibers. These materials are combined and the resulting composite possesses the characteristics of an ordinary ceramic (resistant to heat, erosion, and chemical activity) but does not present the brittle characteristic, therefore making it an ideal substance. I worked on the simulation side of a project that involves using these composites to test their strength when applying certain stresses to a center point. I primarily worked with the computer program FEMLAB to conduct my simulations. FEMLAB uses a series of differential equations to determine the amount of displacement that certain places in the model have with respect to the amount of stress applied. This research will be used in the overall research of developing a ceramic composite to replace metal that currently is used to line combustion chambers and tip shrouds in gas turbine engines.

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Gurminder's Project Page

Intern: Gurminder Sangha, CSU Fresno
Mentor: Jon Burnsed
Faculty Supervisor: Dr. Roy Smith
Department: Electrical & Computer Engineering

MOCVD MONITOR AND PROCESS CONTROL

Metal Organic Chemical Vapor Deposition (MOCVD) is a process used to grow single crystal on an existing template crystal known as a substrate. Monitoring growing film properties such as temperature, composition, thickness, growth rate, and surface smoothness in real time would be extremely helpful to improve the quality of semiconductor film. I used Lab-VIEW and MATLAB to process the data acquired using LASER, DAQ Pad, and lock-in-amplifier (major components of the MOCVD monitor). MOCVD monitor record the sinusoidal variation in reflection caused by interference (constructive and destructive) effects of a growing thin film. MATLAB is then used to find the frequency of oscillation of the growing film and its growth rate.

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Justin's Project Page

Intern: Justin Scott, UC Berkeley
Mentor: Lor Callaghan
Faculty Supervisor: Dr. Noel MacDonald
Department: Mechanical Engineering

SCREAM MEMS

MicroElectroMechanical Systems (MEMS) is a rapidly emerging field of integrating electronics, sensors, actuators and mechanical elements on a single miniature chip. One of the biggest tasks facing current MEMS is finding efficient and reliable methods of machining these tiny structures. Presently, the two main types of production are bulk and surface micromachining. I was involved with a specific type of bulk micromachining known as the Single Crystal Reactive Etching And Metallization (SCREAM) process. This type of processing uses a top-down approach of etching specific patterns into a substrate. I assisted in design of a course that would help provide an overview of the SCREAM process and offer an introduction to processing in the cleanroom to undergraduate engineering students. With the knowledge I gained from this project, I then moved on to assist in the Mechanical Integration of Networked Telecommunications (MINT) assignment. With the MINT project, we aim to design a MEMS piezoelectric filter with a high quality factor for RF devices such as cellular phones. Most of today's RF filters are off-chip components. The MINT project is attempting to integrate a complete filter into one chip and simplify the process. My task was to characterize the amount of stress exhibited in a four-inch silicon substrate after the removal of one side of thermally grown oxide. In doing this I determined if thermal oxidation would affect the curvature of the substrate and force the use of Plasma-Enhanced Chemical Vapor Deposition (PECVD); a less desirable process due to the incorporation of impurities in the deposited film.

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Ethan's Project Page

Intern: Ethan Sundilson, UCSB
Faculty Supervisor: Dr. Donald Janelle and Dr. Michael Goodchild
Department: Geography

GIS/SPATIAL ANALYSIS “COOKBOOK” FOR THE SOCIAL SCIENCES

GIS or Geographic Information Systems is a relatively new field where people can produce maps and analyze spatial data with a few clicks of their mouse. CSISS relates to GIS as it provides tools for Social Scientists such as a how-to guide, in order to make it easy for them to work with spatial data. Therefore, creating a how-to instructional guide (a GIS Cookbook) for using GIS related software is very beneficial to CSISS. The two most common software programs used in GIS are ESRI’s Arc View and Arc Info. Because of the background that I have with these two software packages, I am able to assist in assembling, and publishing the cookbook on the web. In addition to GIS software knowledge, publishing on the web involves cropping pictures, changing data formats and importing and exporting data into and out of programs. Upon completion of several basic cookbook entries, the framework will be laid for future cookbook entries, which will provide detailed instruction into more complicated GIS-related tasks. If this project is accepted by the CSISS Advisory Board, and it is given the green light to continue, the possibility exists that the cookbook portion of the CSISS website will become world-renowned.

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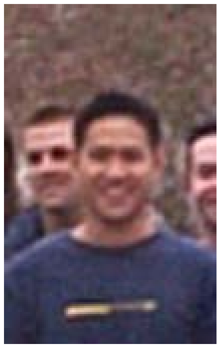
Carlin's Project Page



Intern: Carlin Wong, UCSB
Faculty Supervisor: Dr. Donald Janelle and Dr. Michael Goodchild
Department: Geography

ARCVIEW AND ARCINFO COOKBOOK

The Center for Spatially Integrated Social Science or CSISS is funded by the National Science Foundation. CSISS acknowledges the capacity that space has in human society, and tries to advance the understanding of spatial patterns and processes through research. The main method to integrate this knowledge across different social science disciplines is through Geographical Information Sciences or GIS. To give a person a better comprehension of a place, GIS combines layers of information about that place. These layers combined depend on the purpose. ArcView and ArcInfo are two software products developed by ESRI that allow a person to combine, manipulate, and analyze information layers to create maps. My main duty requires me to explore the applications within both of these programs and document the steps involved to carry out these applications so that someone from a social science discipline will know how to perform the application. We call these “recipes,” and the finished result is called the “Cookbook.” After I develop a recipe, it is entered into the CSISS website via html. Not to mention, for my current task I am assisting in national workshops that introduce GIS and other techniques of spatially integrated social science to young professionals who desire to apply GIS to their field of study.

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Zuag's Project Page

Intern: Zuag Yang, UCSB
Mentor: Paul Forster
Faculty Supervisor: Dr. A.K. Cheetham
Department: Materials

EXPLORATORY SYNTHESIS OF TRANSITION METALS WITH MONOCARBOXYLATES

An interest in hybrid inorganic-organic materials results from their ability to combine transition metals with organic ligands. The main synthetic strategy used by many groups to produce porous versions of these compounds is to replace a mono-functional organic molecule with a rigid, multi-functional organic molecule. Carboxylates, in particular, have yielded highly porous materials with potentially useful properties such as gas adsorption, chiral catalysis, and magnetically ordered porous materials. While materials made with rigid multi-functional carboxylate molecules may have large cavities and high surface areas, the inflexibility of the organic acid normally leads to isolated clusters of metal atoms. We know that flexible dicarboxylic acids, with proper synthetic conditions, allow the synthesis coordination polymers with multidimensional metal ˆ oxygen ˆ metal (M ˆ O ˆ M) connectivity. If the ability of flexible dicarboxylic acids to supply oxygen atoms where they are needed in an inorganic backbone is what leads to such structures, then monocarboxylic acids, under similar synthetic conditions, should also form frameworks with extended metal oxygen networks. We have successfully used this idea to synthesize a family of transitional metal monocarboxylates using mild hydrothermal conditions, with open framework architectures and multi-dimensional M ˆ O ˆ M connectivity. The successful synthesis of new transition metal monocarboxylates offers compelling evidence for our hypothesis that such frameworks are favored by mild, hydrothermal synthetic conditions and carboxylate moieties with the ability to decorate an energetically stable metal oxygen backbone.

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Sam's Project Page

Intern: Sam Ying
Faculty Supervisor: Dr. Donald Janelle and Dr. Michael Goodchild
Department: Geography

APPLYING GEOGRAPHIC INFORMATION SYSTEM METHODOLOGIES TO SOCIAL SCIENCES

GIS is used as the primary technology for many natural science spatial analyses. Some common applications include digitization of polygons from remotely sensed data, buffer analysis, parent map overlay analysis, land suitability analysis, and density estimation. Many of these analysis tools are commonly used in physical geography and other sciences, but have not ventured into the toolboxes of researchers within the social sciences. The Center for Spatially Integrated Social Science (CSISS) has designed a program that introduces spatial thinking and applications to social science research, which range from anthropology to criminal justice. The area of research in which I am involved aims to integrate GIS into the everyday analysis tools used within the social sciences. The product will be a website which contains methodologies that show how to use the common spatial analysis tools in GIS when placed in a social science environment. Information about each analysis tool will also be posted to address the pros and cons of each tool within difference scenarios of research. The primary software applications used to create the methodologies include ArcView 3.2, ArcGIS 8.0, and MapInfo. The final product/webpages will be presented to the CSISS committee in Los Angeles to be approved for continued research in the area.

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