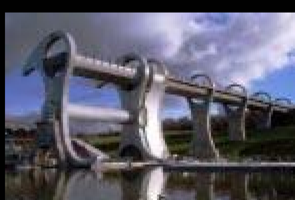
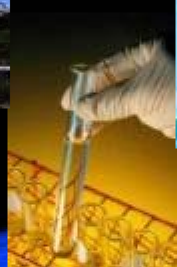
College Research Day

November 5, 2008

Interdisciplinary Research Building Galleria

Book of Abstracts


USF UNIVERSITY OF SOUTH FLORIDA

COLLEGE OF ENGINEERING

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Predicting the Citrate Soluble Loss of the Dihydrate Process

Presenter: Mohammad Abutayeh, Chemical and Biomedical Engineering
Contributor: Scott W. Campbell, Chemical and Biomedical Engineering

A thermodynamic model was developed to predict the limits of distribution of phosphates between the liquid and the solid phases in a reactor used for extracting phosphoric acid from phosphate rock by the dihydrate process. A computer code based on the model was generated to carry out different simulations of the process using several inputs of temperatures and liquid phase content of sulfates and phosphates.

Experimental data of equilibrium constants were regressed and included in the model obtaining a more accurate representation of the thermodynamic equilibrium. In addition, the Edwards-Maurer-Newman-Prausnitz Pitzer based model was incorporated into the model to write the activity coefficients of all species, while published lime solubility data was used to find an expression for the self interaction parameter of phosphoric acid. The model was validated by comparing its predictions to experimental citrate soluble loss data yielding very compatible results. Simulation results for ionic strength, solution acidity, lime solubility, and citrate soluble loss were used to analyze temperature plus solution sulfate and phosphate content effects on the dihydrate process.

Decreasing temperature and increasing sulfate levels was found to raise the acidity and the ionic strength of the solution as well as minimize the citrate soluble loss.

Passive Vacuum Solar Flash Desalination

Presenter: Mohammad Abutayeh, Chemical and Biomedical Engineering
Contributor: Yogi Goswami, Chemical and Biomedical Engineering,
Clean Energy Research Center

A model for a sustainable desalination process has been developed. The simulated process consists of pumping seawater through a solar heater before flashing it under passively created vacuum in an elevated chamber. The vacuum enhances evaporation and is maintained by the balance between the hydrostatic pressure inside the elevated flash chamber and the atmospheric pressure. The developed model employs theoretical thermodynamic relations to describe the process setting it apart from previous empirical correlations.

Impact of Shallow Water Oceanic Turbulence on Gas Transfer at the Air-sea Interface

Presenter: Cigdem Akan, Civil and Environmental Engineering
Contributor: Andrés Tejada-Martínez

Over the past century the study of gas exchange rates between the atmosphere and the ocean has received increased attention because of concern about the fate of slightly soluble, greenhouse gases such as CO_2 released into the atmosphere. Of interest is the oceanic uptake of CO_2 in shallow water coastal regions as biological productivity in these regions is on average about three times larger than in the open ocean. We present surface gas transfer results from large-eddy simulation (LES) of wind-driven shallow water flow with and without wave effects. Wave effects lead to the generation of Langmuir circulation (LC), serving as a mechanism for sea surface renewal of low concentration fluid. LC consists of parallel counter rotating vortices aligned in the direction of the wind characterizing the turbulence advected by the mean flow. Our work is motivated by airborn infrared imagery over Tampa Bay suggesting that LC can affect gas transfer through straining and stretching of the gas concentration boundary layer below the air-sea interface. Preliminary LES shows that shallow water LC can increase surface gas transfer rate by ~30 percent. We focus on the accuracy of surface renewal-based bulk parameterizations of gas transfer velocity, a measure of gas transfer efficiency. We seek to define a bulk parameterization based on commonly measured turbulence parameters, thus potentially useful to scientists making estimates of gas exchange rates on regional scales.

Smart Grid

Presenter: Hector Algarra, Power Center for Utility Explorations

Due to the continuous increase in the electrical consumption, the energy saving has turned into an important aspect in the world. An important part of the consumption of energy worldwide is the energy used to do more comfortable buildings for the user. It is because of this concern that the science has led to the creation of the intelligent buildings. One of the first characteristics this system must offer is the aptitude to relate different elements and to obtain a great versatility. It is simple to relate the functioning of the air conditioning with other domestic appliances, with window opening, etc. With one look to the screen of the PC, the user is completely informed about the condition of his building. And if he wants to modify something, only he will need to touch a limited number of keys. The same available possibilities of local supervision and control can be obtained by means of telephonic connection from another PC, at any place of the world. It will be of great usefulness for the people who travel frequently, or when it is a situation of residences of weekend. The central stations can have several monitors visualizing reports, storing information for analysis of diagnosis, preventive maintenance, statistics, optimization of consumptions, graphs of trends and alarms. The different controls are 1) of accesses, with reading card 2) of detection of fires 3) of comfort 4) of lighting. The air conditioning consumes 60 % of the energy of these buildings, have specific controllers, autonomous controllers used in the distributed control. Different sensors for the higrotermic comfort are 1) temperature 2) dampness 3) pressure 4) enthalpy
5) anemometers 6) of gases and particularly CO_2 for the quality of the air. Also, optimizers with damper controlling to capture the external air and recycling the air of return are used.

Enhancing Transportation Safety and Security Via Scalable Location-based Wireless Applications

Presenter: Sean Barbeau, Center for Urban Transportation Research

This research study introduced the idea of utilizing cellular phones in emergency communications. The research developed two prototypes that employ location-aware technologies in portable form in security applications. First, the "WI-VIA" system that can serve as a modern high-tech "neighborhood watch," enabling law enforcement access to the many "eyes and ears" of the public simultaneously via available cell phones. Cell phones with embedded digital cameras allow the instant capture and remote submission of suspicious circumstances to law enforcement through pictures or video. Not only does this give the responders a visual representation of the situation, but also information such as time, date, voice recordings, and physical location of the submitted occurrence. Using these data, the WI-VIA system intelligently filters, classifies, and displays simultaneous submissions from various locations onto one visual, a computer screen, so the dispatcher can manage the incident more efficiently. The system also allows the dispatcher to handle many more submissions simultaneously while identifying trends and patterns that may not be immediately obvious to a responder in the field. Another aspect of WI-VIA is the reverse 911 component for data-enabled mobile phones. Upon the identification of a threat and the issuance of the appropriate warning, the dispatcher can instantly relay a message to participants with cell phones in a certain geographic area. The real-time control of the when, where, and to whom such information is instantly disseminated is of great interest to law enforcement and public safety officials. An example of such information could be the need to evacuate a particular area due to hurricane/flood warnings. The second prototype described in this report is the Hurricane Evacuation Zone Finder that can help disperse public announcements such as evacuation warnings, evacuation routes, evacuation zones, current shelter locations, re-entry time, etc. The prototype device can "push" evacuation zone information and messages to cell phone users based on their current location. Multi-media messaging could be delivered in users' own languages simultaneously while reaching more people in less time.

Travel Assistant Device (TAD) to Aid Transit Riders with Special Needs

Presenter: Sean Barbeau, Center for Urban Transportation Research

The Americans with Disabilities (ADA) Act provides equal opportunity, full participation, and independence to persons with disabilities. The inability to travel, or the lack of knowledge in accessing the available transportation options, frequently translates into difficulty finding employment, seeking necessary medical services, and participating in educational or vocational training. Simple tasks such as knowing when to pull the cord to indicate the need to exit the bus can be challenging for people with cognitive disabilities. Travel trainers provide one-on-one instruction to develop the skills necessary for independent transit riding. The travel assistant device (TAD) developed for this project is a prototype software system that can be installed on off-the-shelf, GPS-enabled cell phones. The TAD software provides various informational prompts such as playing the recorded audio messages “Get ready” and “Pull the cord now!” and vibrating to alert the rider to pull the stop cord. These prompts are delivered to the rider in a just-in-time method. The real-time location of the rider can be viewed by the travel trainer or family member through a web page. TAD utilizes stop and route data provided by transit agencies in the de facto industry standard Google Transit Feed Specification format. TAD was designed for use by cognitively-disabled transit riders, but can be used by any transit user. Tools that reduce the time and cost of travel training by addressing one or more of the 23 skills necessary for a trainee to travel independently increase the mobility of the population, permit transit agencies to train individuals more efficiently, and reassure the families of these travelers. The field test results with cognitively-disabled young adults successfully demonstrated that TAD supports three of the 23 skills a trainee needs to possess to travel independently: watching for landmarks, recognizing a landmark near the desired bus stop, and signaling to exit at the proper time. TAD also provides confidence and security to individuals using the fixed-route transit system.

An Overview of the Thin Film Solar Cell Program at USF

Presenter: Shweta Bhandaru, Electrical Engineering
Contributors: Chris Ferekides; Diedra Hodges; Vassiles Palekis; Kartikay Singh; Shweta Bhandaru; Ayobami Isaac, Electrical Engineering

Our perennial need for energy and environmental consciousness has led us to research alternative methods of obtaining energy. Among the available options, solar energy has the advantage of being clean and abundant. Solar cells can be made on either rigid or flexible substrate materials each having its own advantages. A flexible substrate allows the device to be rolled over any surface and is lighter compared to rigid solar cells. In this poster, we outline the main activities on flexible and rigid thin film solar cells being currently developed in our lab. The superstrate and substrate configurations will be presented. These configurations will be discussed in light of their applications and substrate choices. Typical IV measurement and spectral response will be presented along with parameters influencing the efficiency of the solar cell. The main objective of our group is to be able improve the efficiency and long-term reliability of solar cells fabricated on flexible and rigid substrates.

Improving Water Quality with Green Chemistry

Presenter: Audrey Buttice, Chemical and Biomedical Engineering
Contributors: Kathryn Bailey; Peter Stroot, Civil and Environmental Engineering;
Joyce Stroot; Daniel Lim, Biology;
Norma Alcantar, Chemical and Biomedical Engineering

Presently, there is an increasing need to develop an inexpensive, effective method of reducing waterborne pathogens that afflict a majority of the world's population. In recent years, a great deal of attention has been drawn to the issue of water contamination, particularly in developing countries where unsanitary water storage is an issue. We have been studying an alternative to the modern technology that relief attempts are currently implanting in troubled areas. Through simple separation techniques a natural compound, known as mucilage, can be extracted from the *Opuntia ficus-indica* cactus that is commonly found throughout the world. Experiments preformed with sediments and heavy metals have suggested that this mucilage is an effective tool for clearing contaminants from water supplies. Current experiments involve the removal of *Escherichia coli* and *Bacillus cereus* bacteria suspended in synthetic waters. Preliminary results preformed with suspensions of *Bacillus* in purified water and the addition of $CaCl_2$ have shown settling to be complete in approximately five to ten minutes with removal rates of up to 98%. Columns containing *E. coli* have shown similar results. Cactus mucilage is an ideal material for water treatment because it is a natural substance, is of low cost, simple to use and is readily obtained and processed. The use of this type of green chemistry not only shows promise as a resource for achieving potable drinking water, but it also overcomes many of the problems witnessed with current relief projects.

Clean Energy Research Center (CERC): Research Projects

Director: Yogi Goswami

Mission Statement: To develop, evaluate and promote commercialization of new environmentally clean energy sources and systems such as hydrogen, fuel cells, solar energy conversion, biomass utilization, etc., that meet the needs of the electric power and the transportation sector through multi-disciplinary research, technical and infrastructure development and information transfer. The Center supports regional economic development of manufacturing and high technology business, in conjunction with the National goals of improving our global competitiveness and technology leadership. Florida has no substantial indigenous supply of fossil fuels. It must import virtually all the energy it uses. However, Florida, the Sunshine State, has good solar and biomass resources. Solar and hydrogen resources and technologies, applied both electrically and thermally, can mitigate the State's fossil fuel dependency, improve the environment and provide substantial economic growth opportunities. Photocatalytic indoor air disinfection and water detoxification is one of the thrust areas of the center which is gaining more attention by the Tampa Bay community. The Center will achieve its mission through scientific research, technical development, infrastructure development and information transfer. Collaboration with energy producers and the transportation sector will support economic development of manufacturing and high technology businesses as well as the nation's goals of global competitiveness and technology leadership.

Florida Energy Systems Consortium (FESC)

In Conjunction with CERC, Director: Yogi Goswami

Mission Statement: To promote collaboration among experts in the State University System for the purposes of sharing energy-related expertise and assisting in the development and implementation of a comprehensive, long-term, environmentally compatible, sustainable, and efficient energy strategic plan for the state. Focus on the research and development of innovative energy systems that will lead to alternative energy strategies, improved energy efficiencies, and expanded economic development for the state. The goal of the consortium is to become a world leader in energy research, education, technology, and energy systems analysis.

Adaptive Software and Manufactures for Different Traffic Controllers

Presenter: Hongyun Chen, Center for Urban Transportation Research
Contributors: Pei-sung Lin; Sachin Rai, Center for Urban Transportation Research

This poster is to provide the system software and relative manufactures for the four general deployed advanced transportation controllers. Advanced Transportation Controller was designed as a powerful processor to manage traffic signal coordination in real time. Typically four types, 2070 model, 170 model, NEMA TS 2 and TS 1, are widely used for open architecture which is compatible with various public versions of controller and PC software. Advanced traffic controllers are more popular in the traffic management these days since the satisfied benefits and several traffic companies have the ability to produce some kinds of controllers. The implementation of controller units require computing traffic network systems and operating traffic applications to intersections by installing suitable controller software that load effective and efficient traffic control tasks. The software support traffic coordination features, preemption features, time-of-day features, detector features, configuration features, hardware features, and protocol features. These kinds of software confirm the continuous and stable work with other suitable software, hardware and equipments.

Boro-hydrides as Potential Energy Storage Candidates

Presenter: Pabitra Choudhury, Department of Chemical and Biomedical Engineering
Contributors: Sesha Srinivasan, Venkat R. Bhethanabotla and Elias Stefanakos

Materials that are light weight, low cost and have high hydrogen storage capacity are essential for on-board vehicular applications. Some reversible complex hydrides are alanates and amides but they have lower capacity than the DOE target (6.0 wt %) for 2010. High capacity, light weight, reversiblity and fast kinetics at lower temperature are the primary desirable aspects for any type of hydrogen storage material. Boro-hydride complexes as hydrogen storage materials have recently attracted great interest. Understanding the above parameters for designing efficient complex boro-hydride materials requires modeling across different length and time scales. A direct method lattice dynamics approach using *ab initio* force constants is utilized to calculate the phonon dispersion curves. This allows us to establish stability of the crystal structure at finite temperatures. Density functional theory (DFT) is used to calculate electronic properties and the direct method lattice dynamics is used to calculate the finite temperature thermodynamic properties. These computational simulations are applied to understand the crystal structure, nature of bonding in the complex boro-hydrides and mechanistic studies on doping to improve the kinetics and reversibility, and to improve the hydrogen dynamics to lower the decomposition temperature. A combined theoretical and experimental approach can better lead us to designing a suitable complex material for hydrogen storage. To understand the structural, bulk properties and the role of dopants and their synergistic effects on the dehydrogenation and/or reversible rehydrogenation characteristics, these complex hydrides are also studied experimentally in our work. Both theoretical and experimental results will be presented.

The Efficiency of Sampling Techniques for NTD Reporting

Presenters: Xuehao Chu, Center for Urban Transportation Research

This paper examines the minimum sample size required by each of six sampling techniques for estimating annual passenger miles traveled to meet Federal Transit Administration's 95% confidence and 10% precision levels for the National Transit Database (NTD). It first describes these sampling techniques in non-technical terms and hypothesizes how they are expected to compare in their minimum sample sizes. It then introduces a newly-developed Excel template that takes an existing sample dataset as input and produces the minimum sample size for each applicable sampling technique. Using this template, it determines the minimum sample size for 83 actual sample datasets that cover 6 modes and 65 transit agencies. It finally summarizes the results in minimum sample size to compare the relative efficiency of these sampling techniques. The paper concludes by drawing implications for both practitioners and researchers.

Directionally Sensitive Acoustic Transceiver Based on the Hearing Mechanism of the Parasitoid Fly, O. Ochracea

Presenter: Jay C. Dlutowski

Conventional SONAR transducers are composed of piezoelectric materials and can be bulky and expensive. Additionally, multiple transducers are needed to sense directionality of the signal, adding complexity both in the system design and electronics interface. This objective of this project is to design, simulate and eventually build a MEMS transducer based on the hearing mechanism of the parasitoid fly, Ormia ochracea. The female O. ochracea hones in on the chirp of a male cricket and implants its eggs in it. Researchers have found that the directional sensitivity is accurate to about 2° - as accurate as human hearing but without our complex nervous system. This accuracy is attained by mechanically coupling the two tympanic membranes with a bridge. When the signal strikes one membrane, the motion is transferred through the bridge, producing interference to the signal once it strikes the second membrane. The degree of dampening between the signals is directly related to the angle. Modeling of the proposed design is presented. A variety of coupling mechanisms geometries are compared. The process flow for building the device is outlined. Transduction methods to be attempted are tunneling feedback and capacitive sensing. Tunneling provides the benefit to extreme sensitivity but also presents fabrication challenges due to the extremely small gap required. The fabrication process uses SOI wafers which would produce a more reliable sensor than with conventional methods. Solid models based on the described process flow and most favorable device geometry are presented.

4D Visualization of Thermally Actuated Microgel Structures

Presenter: S.J. DuPont[1]
Contributors: P.G. Stroot[1], and R.G. Toomey[2]
[1]Department of Civil and Environmental Engineering
[2]Department of Chemical Engineering

Direct visualization of surface attached poly-n-isopropylacrylamide (PNIPAAm) patterns undergoing their volume phase transition was accomplished by use of confocal microscopy. PNIPAAm microgels were crosslinked with trace amounts of the fluorescent monomer methacryloxyethyl thiocarbamoyl rhodamine B, to facilitate visualization of the microgel structure, and then patterned as a series of parallel monoliths on a glass substrate. Monolith patterns were generated with various dimensions of height, thickness, and spacing to observe how the patterned geometry affects swollen geometry. Planar images (x,y) of the microgel patterns were taken at various locations on the z-axis. The series of images were then used to construct 3D iso-surfaces of the PNIPAAm patterns in both the swollen and collapsed states resulting in visualization of the 3D geometry changes in the surface attached microgel patterns. 4D (x,y,z,t) visualization of the surface attached microgel patterns was accomplished by taking a z-axis image series at various time points during the volume-phase transition. At the location of surface confinement, no lateral swelling of the microgel was observed but at sufficient distances from the surface, lateral swelling began to increase with distance from the surface resulting in the formation of mushroom shaped monoliths. At sufficient aspect ratios and monolith spacing, buckling of the swollen monolith tops was observed suggesting severe mechanical instability caused by the high osmotic stress at the free surface. Interrogation of surface attached microgels in this way can provide useful information relating to both geometric and volumetric changes in the microgel as a result of volume-phase transition induced swelling and deswelling. This information can be useful in generating models to predict the behavior of surface attached microgels ultimately facilitating the design of innovative technologies based on the actuation of stimuli sensitive microgels.

Community-scale Modeling of Biomass Burning Emissions

Presenter: C. Einmo, Environmental and Occupational Health
Contributor: A. Stuart, Environmental and Occupational Health

The goal of this project is to apply the Community-scale Model for Air Quality (CMAQ) to the Tampa Bay area in order to observe the significance of biomass combustion products upon urban air quality. An 8-km grid-based Eulerian modeling framework is proposed with meteorological and emissions data for year 2002, augmented with hypothetical anthropogenic emissions of particulate matter and O_3 precursors to simulate biomass burning practices representative of various metropolitan centers. Poor air quality due to biomass burning within individual households is widely-regarded as one of the major causes of morbidity and mortality worldwide; however the significance of biomass combustion upon outdoor urban air quality remains poorly understood. Field observations of background PM_{10} levels in areas where biomass is the primary fuel source imply that the cumulative outdoor effects may be as significant as those from indoor combustion, but to the authors' knowledge ours is the first attempt to address this by community-scale computational modeling.

Green Pathways for Extraction of Therapeutic Compounds From Natural Materials: CO_2 Extraction of Blueberries

Presenter: N. Elsayed
Contributor: Aydin K. Sunol, Chemical Engineering

Medicinal extracts from natural components are becoming incredibly popular as new research uncovers the benefits of such compounds and with the availability of green technologies that enable the isolation and extraction. For example, Blueberry abstracts have been found to have the highest amount of anthocyanin content per serving than any other fruit or vegetable. Anthocyanins are known to be powerful antioxidants and are linked to the reduction of heart disease and cancer. Recent studies suggest that they may also play a role in slowing down age related diseases such as memory loss and tissue damage caused by Alzheimer's. In addition the berries have a variety of essential vitamins and minerals that are important for overall health.

There is a variety of extraction methods used to obtain these desirable compounds from blue berries such as common solvent and chemical extraction, chromatography and soxhlet extractions. An alternative extraction method is using supercritical fluids. As compressed gases approach their critical points, the extraction power increases tremendously and many component solubilities increase proportionally. Recovery of the solvent has been shown to be less costly and more energy efficient over liquid solvents.

Supercritical CO_2 is among the leading supercritical fluids used because it possesses many attractive features. Carbon dioxide as a gas is relatively safe to use as it is nonflammable and it has a low toxicity level. In the supercritical phase, very minute pressure changes result in relatively large changes in density which then leads to favorable changes in solvating properties. Supercritical CO_2 possesses low viscosity, interfacial tension and diffuses like a gas allowing for much better mass transfer within a system as opposed to regular liquid solvents. To increase the solvating power in the supercritical phase, a small amount of a co-solvent (ethanol) was used.

Cactus Mucilage: A New Technology for Removing Arsenic From Drinking Water

Presenter: Dawn I Fox, Chemical and Biomedical Engineering
Contributors: Thomas Pichler, Geography; Daniel Yeh, Civil and Environmental Engineering; Norma Alcantar, Department of Chemical and Biomedical Engineering

Arsenic (As) contamination of drinking water, while a global public health problem, is also an important local concern. Arsenic release from the upper Floridian aquifer has implications for groundwater source water suppliers as well as the Aquifer Storage Recovery program. Conventional technologies used to remove As are energy-intensive and generate large volumes of waste. We propose to develop an environmentally-friendly alternative based the cactus mucilage. Cactus mucilage is an extract from the *Opuntia ficus-indica* (also known as Nopal and Prickly pear cactus). In previous work, cactus mucilage was shown to flocculate suspended solids and remove As from water. In the current study, we are investigating the interaction between the mucilage and the As. Batch kinetic and equilibrium experiments were performed. Our results suggest that a complex is formed between the mucilage and the solvated As ions.

Development of Maintenance of Traffic (MOT) Training Program for Incident Responders in Florida

Presenter: Enrique Gonzalez-Velez, Center for Urban Transportation Research
Contributors: Pei-Sung Lin, Center for Urban Transportation Research

Most current maintenance of traffic (MOT) training programs are typically designed for road construction projects. The training courses offered at different levels in Florida are targeted to either construction contractors or roadway designers. Some incident-responding agencies have specific incident management training and site management, but the coverage of MOT varies significantly. It has been well recognized that successful traffic incident management requires effective planning and consistent MOT setup to ensure the safety of all incident responders and the mobility of the traveling public through incident locations. It is also vital for incident responders to have full communication, coordination, and cooperation during a traffic incident. Through a USF UCITSS project sponsored by the Federal Highway Administration, the Florida Department of Transportation, and Florida Atlantic University, the Center for Urban Transportation Research (CUTR) at the University of South Florida has developed a comprehensive and integrated MOT training program specially tailored to the needs of incident responders such as law enforcement, fire and rescue, emergency medical service, transportation agencies, road ranger service, and towing service. The major objective of the project was to develop a comprehensive, integrated, and practical MOT training program to enhance the safety of all incident responders, improve the mobility of the traveling public through incident locations, and obtain consensus, support, and utilization of the MOT training program from all incident-responding agencies.

Mechanical Properties and Adhesion of CdTe/CdS Thin Film Solar Cell Stacks Deposited on Flexible Foil Substrates

Presenter: Deidra Hodges, Electrical Engineering
Contributors: Chris Ferekides; Vasilios Palekis, Electrical Engineering

Cadmium telluride (CdTe) is a leading thin film photovoltaic (PV) material due to its near ideal band gap of 1.45 eV, its high optical absorption coefficient and availability of different device fabrication methods, for solar energy conversion. CdTe in thin film PV solar cells promises to be a low cost alternative to common silicon technology. A thin film of CdTe with thickness of approximately 2 μm will absorb nearly 100% of the incident radiation. The status the thin film CdTe/cadmium sulfide (CdS) solar cell is more than 16.5% efficiency for devices on conducting glass substrates, 7.8% efficiency for devices on flexible metallic substrates, and 8.6% efficiency for devices on flexible polymer substrates. For producing highly efficient thin film CdTe/CdS solar cells, the device structure has to be relatively free of residual stresses. Residual stress can result in undesirable effects which negatively impact the overall solar cell performance, including, excessive deformation, fracture, delamination and microstructural changes in the materials. If films lift from the substrate, device failure can result making poor adhesion a reliability problem. Therefore, excellent adhesion and low stress are required of a CdTe/CdS thin film solar cell device. In this study, we have characterized and analyzed the substrate-film stack stress and adhesion by Nanoindentation, SEM, and XRD analysis, as a function of deposition process parameters pressure, power, and temperature and film thickness. Results are presented in this study.

Assessment and Impact of Total Mercury Levels in the Hillsborough River, Tampa, FL

Presenter: Joniqua Howard, Civil and Environmental Engineering
Contributors: Ken Thomas; Erlande Omisca; Maya Trotz,
Civil and Environmental Engineering;
Trina Halfhide; Fedna Akiwumi, Geography
Ryan Michael; Amy Stuart, Public Health

Florida, the fourth largest state in the U.S. and a leader in commercial fishing in terms of fish catches per day has become increasingly concerned about its fresh water and marine ecosystems. Currently, several fish advisory warnings and 102 water bodies within Florida have been designated as impaired by mercury. The US Environmental Protection Agency's recommended maximum acceptable level of contamination for mercury is 2 μg/L, 12 ng/L, and 0.5 μg/g for drinking water, surface water, and fish, respectively. In this study, nineteen popular fishing parks along the Middle and Lower Hillsborough River were investigated for total mercury concentrations in water, sediment, and fish. Findings from the study suggest that mercury may be of high concern for Hillsborough River residents.

Distributed Energy Program

Presenter: Mujahidul Islam

In this poster clean energy production is seen as an urge to counteract global climate change and the higher frequencies of occurrence of all kinds of environmental calamities, which are proved to be some of the adverse effects of excessive green house gases emission in the surrounding environment. In the front line of clean energy resources - solar, wind and hydro power is obviously cleanest and cheapest but highly fluctuating compared to fuel cell, biomass or geothermal energy sources. Moreover, these sources are not abundant in every geographic area and thus they may need to be transmitted through existing transmission network or may need to drive industry standard equipments. Specifically integration of renewable energy sources to smart grid architecture, suitable technology supporting energy conversion and energy storage with reasonable cost is very important. A special kind of controlled valve associated with parallel storage is proposed to counteract unwanted fluctuation in a wind turbine or hydro power driven system. The poster also intended to draw attention on the fact that for secure and manageable electric power transmission, all fluctuating sources must be stabilized enough to be coupled and meet our energy demand.

Renewable Solar Energy at Lowry Zoo

Presenter: Jerry Jean-Louis, Power Center for Utility Exploration

The goal of this research project is to elaborate methodologies so we can analyze and optimize the technical, economic and environmental benefits of a renewable grid connected Photovoltaic system for electrical power production. We can achieve this by the development of an advance peak load shaving technology for the reduction of the maximum demand and reverser power protection. Renewable energy resources especially using photovoltaics-PV hold the promise of delivering electric power that is not only reliable, but can be created to be compatible with a natural environment in harmony with people and animals. Such systems supply clean power and serve to mitigate the peak power demand.

Water Budget Modeling: A Tool for Sustainability

Presenter: Caryssa Joustra, Civil and Environmental Engineering
Contributor: Daniel H. Yeh, Civil and Environmental Engineering

In order to define and promote green buildings, the U.S. Green Building Council (USGBC) created the Leadership in Energy and Environmental Design (LEED) rating and certification system. Although water efficiency is a small category in the rating system, water management has a large impact.

Analysis of water use requires knowledge of both initial and final water values, but those values depend on the particular water management option that has been implemented. Everything is relative; integrated building water management (IBWM) is needed to provide measurable values for each alternative. For example, the use of potable water can be lowered by installing toilets that use fewer gallons per flush (gpf) or by installing sinks that use fewer gallons per minute (gpm). The effect of each option is already given: the demand for potable water will decrease; however, the magnitude of that decrease is unknown in each case. A quantitative decision-making tool, taking into account various options for water conservation and reuse, is needed. By assigning values to the unique options, the impact of different methods can be measured with respect to the system and to each other.

The movement of water throughout a system is an observable event; flows and volumes are measurable and verifiable. Hence, a model was chosen as the best medium by which to sort the information and serve as a decision-making tool. Adaptability to numerous flow setups, such as low-flow fixtures and various water sources, allows for each option affecting water use to be considered. All conceptualized aspects are networked using the *Systems Thinking Experimental Learning Laboratory with Animation* (STELLA) visual modeling software (ISEE Systems) to form a coherent system. STELLA was chosen as the development tool for the model due to its visual mapping, simulation features, and user-friendly interface.

The model has as many applications as can be imagined by its users. Data can aid the user in making the best economic decision, as well as more accurately determine and predict water use and reuse. If sensors are incorporated within a building, the STELLA model can run simulations from the web using real-time data. Collected data may then be used to calibrate the model so future predictions regarding water budgets are obtainable.

Evaluation of the Effectiveness of Rear-View Camera Systems as a Countermeasure for Truck Backing Crashes: Lessons Learned from Actual Field Deployment

Presenter: Achilleas Kourtellis

A growing awareness is emerging regarding backing crash problems in the U.S. "No view" or "limited view" are commonly cited as the cause of backing crashes, which means that backing crashes occurred because the driver did not see the struck vehicle, object, or pedestrian in the rear. Unlike cars, trucks have huge areas directly behind them that cannot be seen by drivers. The size of this "no view" area in the rear becomes bigger as vehicle size increases.

According to the NHTSA most recently complete study, rear-view video systems are an effective means of allowing the driver to see behind the vehicle, while sensor-based systems do not perform well enough to effectively prevent backing crashes. Based on the results of NHTSA study, 73 camera-based rear view systems were deployed on various sizes of trucks and closely monitored to evaluate the effectiveness of the deployed systems, including driver feedback.

It was learned that image quality is very important and that poor image quality in the early stages of system implementation can discourage driver acceptance of the system. The before/after crash study showed that installing the system helped companies avoid 40 percent of potential backing crashes. This study confirms the effectiveness of rear-vision camera as a countermeasure for truck backing crashes with actual deployment and multiple driver surveys.

Assessing the Public Involvement Practices of the Florida Department of Transportation

Presenter: Jeff Kramer, Center for Urban Transportation
Contributors: Kristine Williams; Karen Seggerman; Alexander Bond, Center for Urban Transportation

Although public involvement is now a routine part of transportation planning and project development in Florida, the current state of the practice is not well documented. To fill this information gap, the Center for Urban Transportation Research (CUTR) at the University of South Florida conducted a comprehensive assessment of public involvement practices for the Florida Department of Transportation (FDOT). The assessment addressed public involvement practices at all phases of transportation decision making and included various divisions of the FDOT Central and District Offices.

Capacity Building for Metropolitan Transportation Decision Makers

Presenter: Jeff Kramer, Center for Urban Transportation

MPO Board members face numerous challenges. Key among these are limited knowledge of MPO planning concepts and processes. The Florida MPOAC has developed a comprehensive training program (the MPOAC Institute) to bring MPO Board members up to speed. This poster shares key lessons learned from the MPOAC Institute experience.

Analysis of Alternate Route Choice Behavior with Variable Message Signs Using Hybrid Tree Method

Chanyoung Lee, Center of Urban Transportation Research

During the last two decades, extensive research on Driver Behavior under Information Provision has been conducted based on the Stated Preference (SP) approach (which involves user surveys). The logistic regression model has frequently been applied to analyze the survey data. In general, the logistic regression model is a useful tool for analyzing data with a binary response variable, but, this model does not work well when collinearity, nonlinearity, or interactions are present in the dataset. To avoid this problem, Artificial Neural Networks (ANN) have recently been applied in many studies related to this topic. An advantage of the ANN approach is that it provides good prediction accuracy, but it is very difficult to interpret the results.

This study adopted a method called LOTUS “Logistic Tree with Unbiased Selection” to analyze driver compliance behavior with ATIS (Advanced Traveler Information Systems). Driver behavior under information provision through VMS data has been collected using the Stated Preference (SP) approach.

The results from LOTUS were compared with the results obtained using logistic regression and ANN. The comparison showed that LOTUS is able to provide a very interpretable hierarchical structure while maintaining reasonable prediction accuracy.

Titanium Dioxide Aerogel Catalyst Development for Environmental Applications

Presenter: Haitao Li, Chemical and Biomedical Engineering
Contributors: Aydin Sunol; Sermin Sunol, Chemical and Biomedical Engineering

Photocatalyst has been widely used in environmental purification and remediation. Among current photocatalysts, titanium dioxide based photocatalyst has been becoming more popular because of its outstanding properties. Titanium dioxide can be excited with UV light and generate highly oxidizing electron-hole pairs due to its band-gap.

In this poster, research work of using supercritical fluids technology combined with sol-gel method to synthesize a novel and effective TiO_2 based photocatalytic system which can be excited by visible light and UV light for degradation of some harmful and toxic contaminants will be presented. The photocatalytic effectiveness is evaluated by oxidation reactions for phenol solution.

Seepage Rates in Closed Basins

Presenter: V. Martysevich, Civil and Environmental Engineering
Contributor: M. Nachabe, Civil and Environmental Engineering

The purpose of the study is to apply a field based method to estimate seepage in closed basins for urban drainage analysis. Five locations in Hillsborough County, Florida, were instrumented with wells with pressure transducers measuring water level fluctuations. For closed basins with surface water – groundwater interaction, evaporation rates were determined using data from a weather station and Penman-Monteith FAO56 method, and then seepage rates were calculated from a water budget. Two methods to estimate seepage rates in locations with subsurface water were compared: (a) mass balance approach and (b) Darcy's equation. Seepage rates varied greatly depending on conditions specific to the site. The results of the study indicate that simple and relatively inexpensive field methods can give reasonable seepage predictions that can be used in flood modeling. The obtained values indicate that seepage does not provide adequate drainage relief in closed basins. Another finding is the magnitude of the local recharge to the Floridan aquifer.

An Analytical Model for Screening Repositories for Subsurface Storage of Carbon Dioxide

Presenter: R. Okwen, Civil and Environmental Engineering
Contributor: J. Cunningham, Civil and Environmental Engineering

Reducing greenhouse gas emissions is one of the biggest challenges of the 21st century. Carbon capture and storage (CCS) has been proposed as a potential strategy for relieving atmospheric emissions of CO_2 thereby mitigating global climate change. CCS involves the collection, compression, and injection of carbon dioxide (CO_2) from major emission point sources into confined formations.

We have developed a screening tool for assessing the suitability of deep formations for underground storage of CO_2, using a combination of analytical equations. We considered the injection of CO_2 at a constant rate into a confined, homogeneous, deep saline aquifer via a single vertical well. The analytical equations give predictions of (1) location of the CO_2-brine interface, (2) variations of formation pressure in space and time, and (3) CO_2 storage efficiency. We have evaluated how well the analytical model agrees with TOUGH2 numerical model under different sets of input conditions. When formation conditions and assumptions in TOUGH2 are chosen to be similar to those of the analytical model, the two models show excellent agreement in their estimates of fluid saturation and formation pressure. Sensitivity studies show that agreement between the analytical model and TOUGH2 depends strongly on gravity and relative permeability function applied in TOUGH2. Predictions of CO_2 storage efficiency herein are in good agreement with those in the literature, which employ complex numerical simulations. This analytical model is rapid, cost-effective and requires fewer input parameters than numerical simulations. Therefore, it could be used as a screening tool for subsurface sequestration of CO_2.

Statistical Normalization of Reliability Indices for Common Weather Conditions

Presenter: Adedamola Omole

The weather and reliability (WAR) project investigates the effects of weather conditions on the reliability of power supply. The current effort involves collecting data from weather stations located in various management areas (MA) under study and using the data to improve the reliability indices for common weather conditions.

The WAR project is a unique investigation into the effects of weather conditions on reliability. The analysis involves systems across the entire Florida peninsula. Normalizing utilities reliability indices for variation in common weather conditions allow reliability engineers to focus on other reasons for any shift, up or down, in the reliability indices without the guesswork involved in evaluating the effects of weather.

Structural Properties of CdTe Thin Films for Solar Cell Applications Deposited on Flexible Foil Substrates

Presenter: V. Palekis, Electrical Engineering
Contributors: Chris Ferekides; Elias k. Stefanakos;
D. Hodges, Electrical Engineering

Cadmium telluride (CdTe) is a leading thin film photovoltaic (PV) material due to its near ideal band gap of 1.45 eV, its high optical absorption coefficient and availability of different device fabrication methods, for solar energy conversion. CdTe in thin film PV promises to be a low cost alternative to common silicon technology. A thin film of CdTe with thickness of approximately 2 μm will absorb nearly 100% of the incident radiation. The status the thin film CdTe/cadmium sulfide (CdS) solar cell is more than 16.5% efficiency for devices on conducting glass substrates, 7.8% efficiency for devices on flexible metallic substrates, and 8.6 efficiency for devices on flexible polymer substrates. In this study, the growth of CdTe thin films by close-spaced sublimation (CSS) has been investigated. Thin films of CdTe were deposited by CSS onto substrates held at temperatures in the range of 300°C to 600°C. The effect of the substrate temperature and the growth rate on the structure and surface morphology of CdTe films were analyzed. The structures and surface morphology of the CdTe films were determined by XRD and SEM. Results are presented in this study. Flexible solar cell structures are also being fabricated and evaluated.

Evaluation of Double Composite Action in Steel Bridges

Presenters: Purvik Patel; Rajan Sen; Niranjan Pai, Civil and Environmental Engineering;
Dennis Golabek; Steve Stroh, URS Corporations
Contributors: Florida Department of Transportation

Steel girder bridges are commonly designed to take advantage of composite action with a concrete deck slab to improve the load carrying capacity and performance of the girder. This idea can be extended to "double-composite" behavior by including a concrete slab in the plane of the bottom slab in the negative moment region of the girder in continuous structures. In addition to the obvious savings in replacing steel flange material with less costly concrete, it offers the potential for further savings due to increased stiffness over the supports with a corresponding favorable redistribution of moments, reduced deflections and improved fatigue performance. Provision of a composite bottom flange in the negative moment region of a continuous span also offers the potential for meeting compactness criteria for a thinner web due to the lowering of the neutral axis, thus allowing a plastic design methodology and further improved girder performance. This study describes on-going experimental and numerical investigations to develop appropriate design rules that would allow such structures to be built.

Thrombogenicity Assessment of Single Crystal SiC through *in-Vitro* Platelet Adhesion and Activation Evaluation

Presenters: N. Schettini,[1,4] FCoE-BITT Scholar
Contributors: M. Jaroszeski,[2,4] K.E. Muffly,[3] S.E. Saddow[1,4]
[1] Electrical Engineering, [2] Chemical and Biomedical Engineering,
[3] Pathology and Cell Biology, [4] FL Center of Excellence BiTT

The thrombogenicity of crystalline Silicon Carbide (SiC), in its cubic (3C-SiC) and hexagonal (4H-SiC and 6H-SiC) forms, has been evaluated and compared to silicon (Si), the leading material for biosensing applications. SiC is a hard, chemically robust material, very well suited for harsh environment applications, and has been suggested to have very good biocompatibility. Additionally SiC, in its amorphous form, has been used as a coating for medical implantable devices such as bone prosthetics and cardiovascular stents. However, assessment of single crystal SiC which can form the basis of advanced sensors for cardiovascular applications has not been reported. In this study we have assessed platelet reactivity, which has been measured by the degree to which platelets in suspension adhere to a surface *in vitro*, including platelet density, circularity and the presence of clumps. Statistically higher platelet adhesion was observed on Si than on SiC, using fluorescence microscopy. Imaging at high magnification surprisingly revealed that adhering platelets on the 4H-SiC and 6H-SiC surfaces presented higher activation and clumps than on 3C-SiC surfaces. 3C-SiC surfaces showed less aggregation and activation with mostly circular morphology of adhered platelets while Si showed an elevated presence of non-activated (Circular) platelet clumps. These results suggest that 3C-SiC is a promising candidate for biosensing applications in the blood stream due to its low thrombogenic characteristics.

Fabrication of Stimuli-responsive Poly-NiPAAM Surfaces for Biomedical Applications

Presenter: Chamila S. Siyambalapitiya
Contributors: Samuel J. DuPont[3], J. Wang[1], R. Toomey[2], Peter G. Stroot[3]
[1]Electrical Engineering, [2]Chemical and Biomedical Engineering,
[3]Civil and Environmental Engineering

This research is geared towards reconfigurable surfaces that can provide catch and release of targets from nanometer to micron sizes. The surface configuration is an important factor in cell attachment and detachment. This poster will compare the characteristics of (*N*-Isopropylacrylamide (NIPAAm)) polymer thin films coated by two coating techniques, popular spin coating technique and the customary developed blade coating technique. Also, the incorporation of polymer-"soft" and "hard" material deposited by atomic layer deposition (ALD) system for bio detection and cell capturing were investigated.

The Impact of PCM Encapsulation of Calcium Oxide

Presenter: Brandon Smeltzer, Chemical and Biomedical Engineering
Contributors: Sermin Sunol; Aydin Sunol, Chemical and Biomedical Engineering

Delayed energy release has several implications that lend it to viable commercial products in areas such as self heating applications. One common reaction used in self heating products is calcium oxide with water. In addition to being highly exothermic, the reaction is also very fast. These two properties of the calcium oxide reaction with water present a challenge with temperature control in the self heating arena. One way to get a flexible element of control with the reaction is the addition of a phase change material (PCM) such as polyethylene glycol (PEG). Encapsulation of calcium oxide particles with PEG provides multiple functions with regards to the reaction. First, the coating protects the calcium oxide particles from undergoing a reaction with water vapor in the air or liquid water prior to the desired time. Second, the coating dissolution in water provides a time delay before the exothermic reaction proceeds. Third, the presence of PEG has an impact on the reaction rate slowing it down. For these reasons, investigations into the effect of PEG encapsulation on the calcium oxide reaction with water are being conducted. Promising results have shown that PEG encapsulation of calcium oxide adds an extra degree of freedom for extending the calcium oxide reaction with water and controlling the temperature as well.

Tallahassee/Leon County Corridor Management Program

Presenters: Kristine Williams, Center for Urban Transportation Research

In the Fall of 2000, the residents of Tallahassee-Leon County passed an extension of the one-cent sales tax for transportation improvements. In May of 2002, the Blueprint 2000 Intergovernmental Agency, set up to oversee the projects, initiated a separate project to develop a comprehensive corridor management program for the City of Tallahassee and Leon County. One goal of the project was to preserve right-of-way for future transportation projects as development occurs (corridor preservation). Another goal was to strengthen local policies and regulations for managing access on the community's major transportation routes (access management). In this way, both communities could advance the Blueprint mission of more effective infrastructure management and in turn help make the most of public sales tax revenues.

The Center for Urban Transportation Research at the University of South Florida was retained to prepare comprehensive plan amendments, ordinances, and design standards to accomplish these goals. The project involved a comprehensive set of policies, standards, and procedures for local corridor management. It also involved numerous jurisdictions, agencies, and stakeholders. This paper provides an overview of the project, highlights of the proposed policies, and issues faced in program development.

Comparison of Analytical Methods with Solid-phase Extraction and Solid-phase Micro-extraction with Derivatization for Detecting and Quantifying Bisphenol-A in Water

Presenter: Won-Seok Kim, Civil and Environmental Engineering
Contributor: Jeffrey A. Cunningham, Civil and Environmental Engineering

Providing a sustainable supply of potable water worldwide will be one of the most important engineering challenges of the 21st century. Meeting this challenge will require that we transform treated wastewater back to potable water. One promising method, particularly in arid regions, is soil aquifer treatment (SAT). During SAT, treated wastewater is ponded in an unlined surface impoundment and is allowed to infiltrate through the vadose zone, thereby recharging a groundwater aquifer. It is generally believed that SAT improves the quality of the treated wastewater through physical, chemical, and biological processes that occur during the percolation through the unsaturated zone.

SAT is a viable technology only if it can remove endocrine-disrupting compounds (EDCs) that may be present in the wastewater. In the present study, we focus on one particular EDC, bisphenol-A. We have targeted bisphenol-A because it is one of the EDCs most commonly found in wastewater effluent and because of its suspected health effects on humans.

We are conducting laboratory-scale experiments to identify the mechanisms that are primarily responsible for the removal of bisphenol-A during SAT. This requires that we first develop a reliable method for detecting and quantifying bisphenol-A in water samples. We have developed quantification methods based on solid phase extraction (SPE) and solid phase micro extraction (SPME) with derivatization, and analysis via gas chromatography (GC) with mass spectrometry (MS).

Impact of Safe Routes to School on Student Travel Modes Shifting: Based on the Before/After Period Survey

Presenter: Zhao Ziguang

Abstract not available.

Adaptive Driving System for People with Disabilities

Presenters: Matthew Fowler; Sravan Elineni, Mechanical Engineering
Contributors: R. Berhane; B. Ying; K.J. De Laurentis; R. Alqasemi; R. Dubey, Mechanical Engineering

This poster presents the current need for a driving simulator for people with disabilities and offers a solution to meeting those needs. It further discusses future research in making the simulator a more effective driver training tool so that drivers will be adequately equipped to safely rejoin the workforce using personal vehicles.

As the population of the United States grows and cities expand in area, we become increasingly more dependent on personal vehicles for transportation. These tools are critically important to a person's ability to maintain employment and a sense of social status. However, a problem arises when a person becomes disabled and can no longer operate motor vehicles without modification. Currently, there are several commercially available vehicle modifications to accommodate persons with physical disabilities. However, there are few ways for an individual with disabilities to safely practice and become proficient with the new vehicle modification interface.

The goal of this project is to combine a driving simulator with a vehicle modification system to accommodate users with a variety of disabilities. With increasing demand, the finished project will be available to the public. Future direction involves research in making the simulator more realistic to the user. Some topics may include an enhanced visual environment, force feedback for collisions and traffic events, and intelligent traffic simulation.

Florida Center of Excellence for Biomolecular Identification and Targeted Therapeutics (FCoE-BITT): An Introduction to Core Lab Services

Presenter: Leigh West[2]
Contributor: Stanley Stevens Jr[1]
[1]Proteomics Core Director, [2]MCCIL/T3L Core Director

The Florida Center of Excellence for Biomolecular Identification and Targeted Therapeutics (FCoE-BITT; www.bitt.usf.edu), located on the Tampa campus of the University of South Florida, is a comprehensive center that enhances interactions between scientists and engineers to identify molecules of human health significance and develop novel methods for use in diagnosis, prevention and treatment of human disease. FCoE-BITT encompasses the full range of product development, from discovery to commercialization. It is expected to create an infrastructure that supports collaboration across several academic units (USF Health, USF College of Arts and Sciences, USF College of Engineering) and move research into commercial applications through its close collaboration with various technology transfer resources. In addition to hiring several new research faculty, the FCoE-BITT will house four supporting laboratories with state-of-the-art instrumentation. Two of these will be highlighted. The Proteomics Facility will support large-scale protein isolation, identification and characterization (mass spectrometry, differential expression profiling, analysis of post-translational modifications of proteins, quantitative proteomic analyses). The Microbial Cell Control and Identification / Tissue Toxicity Testing Lab (presently operational; located in the Kopp building, ENG) is a multi-purpose lab providing biological lab resources, material fabrication and analysis equipment, custom lab services, consultation and training. Current clients are using these facilities and services for diverse multidisciplinary projects involving sensor development, tissue compatibility testing of implantable devices and surfaces, polymer and metal surface deposition and drug discovery/targeted delivery.

A Biologically-Inspired Computational Geometric Method for Effective Identification of Molecular Conformations

Presenter: Athina N. Brintaki, Industrial and Management Systems Engineering
Contributors: Susana K. Lai-Yuen, Industrial and Management Systems Engineering

Bionanotechnology is the new frontier in research and technology and is vital for the realization of biomedical and nanoscale products. It consists of manipulating biological molecules to create structures or devices with new molecular arrangements. By manipulating or assembling molecules, we will be able to create lighter and stronger manufacturing materials, enhanced textiles and precise nanoscale devices with new capabilities for diagnosis and treatment of diseases. A major challenge in modeling molecules is the exponential explosion in computational complexity as molecules can contain thousands of atoms and hundreds of degrees of freedom. In this work, a new generic molecular model called enhanced BioGeoFilter (eBGF) is presented to effectively identify chemically-feasible molecular conformations independently of type, size and topology. The proposed eBGF generic approach consists of a two-layer hierarchical data structure that considers certain chemically-motivated factors to rapidly obtain molecular conformations that are chemically feasible. The eBGF generic algorithm is presented as a less complex and effective molecular modeling tool that minimizes molecular conformational search and speeds collision detection queries.

Design of a Remote Controlled Omni-Directional Rotating Platform for Dance

Presenters: Jeff Cama; Brent Savage; Sean Motta; Mechanical Engineering
Contributors: R. Livernois; P. Schrock; K.J. De Laurentis; R. Dubey; Mechanical Engineering; M.L. Morris, Visual and Performing Arts

This project involves the design and development of a moving platform with an independently rotating top that can be used on the stage during theatrical and dance performances. This is a joint project between the University of South Florida's School of Theater and Dance (Merry Lynn Morris – design inspiration) and the Rehabilitation Robotics Lab (Mechanical Engineering (M.E.) students – design and development). The M.E. students were given the task of, among many things, developing a sturdy, robust, easily maintainable, and inexpensive moving platform with a rotating top to add another choreographic element to Ms. Morris' unique style of dancing.

This poster displays the design and development work of the undergraduate M. E. students for this 60 inch diameter platform that holds up to five-hundred pounds, is remote controlled, is omni-directional, and has an independently rotating top surface. It also has the ability to fold up to fit through doorways and is wheelchair accessible. For future additions, a programmable feature may be added so it can travel across the stage by itself. This platform meets all original needs and desires and there is currently nothing like it on the market. This group is also currently researching uses for this system in other fields.

Design Modifications to a Hands-free Wheelchair for Dancers with Disabilities

Presenters: Sean Motta; Brent Savage; Adriana Chacon; Michelle Smith, Mechanical Engineering; Jeff Cama; John Camacho, Computer Science and Engineering
Contributors: R. Livernois; K.J. De Laurentis; R. Dubey; Mechanical Engineering; M.L. Morris, Visual and Performing Arts

Individuals with physical disabilities and their need for assistive technology have increased in the past years. According to the 2000 U.S Census Bureau, there are more than 21.2 million people who have mobility impairments. Many products have been developed to assist these individuals in their every-day activities. However, development of recreational devices for the performing arts has received little attention. In considering this deficit/need, a power wheelchair modification to allow hands-free operation was developed for dance through an initiative from faculty in the School of Theatre and Dance (design inspiration) working collaboratively with faculty and students in the Department of Mechanical Engineering (design and testing).

Previous work included the addition of Hall Effect sensors mounted on a pair of spring loaded tilting brackets under the seat, which connected to the wheelchair's control board, bypassing the joystick electronics, enables body lean operation of the chair. In this manner, the wheelchair user can move the chair without the use of his/her hands, allowing more possibilities for artistic expression.

This research involves improving the design of the tilting mechanism by experimenting with different compression spring deformations by analyzing the seat's displacement under load in the USF Motion Analysis Lab. Additionally, the design of armrests to provide another choreographic element to the chair is being pursued. Both of these design improvements are the beginnings of making this chair available for universal use: refinement of spring stiffness for varying users and tasks, and armrests for user safety and comfort.

Robot Kinematics Based Model to Predict Compensatory Motion

Presenters: Derek Lura; Stephanie Carey, Mechanical Engineering
Contributors: M. Jason Highsmith; Rajiv Dubey, Mechanical Engineering

This presentation covers the method and motivations for the development of a model of the human upper body for use in predicting compensatory motions. The model is a 15 degree of freedom manipulator defined using equations for robot kinematics. The concepts of Denavit and Hartenberg parameters, forward and inverse kinematics, homogeneous transforms and their use in the model is explained. Compensatory motion is the change in motion of anatomical joints required to accomplish a task when one or more anatomical joint is missing or damaged. The model was developed in MATLAB and can be easily reconfigured to find the compensatory motions when a joint is removed or restricted. By configuring the model to represent various prostheses we can find the compensatory motions required for a theoretical user to perform the tasks of lifting a box, turning a wheel, opening a door, and drinking from a cup. Tasks are represented by trajectories and can be added to the model. By analyzing the compensatory motions we hope to be able to improve the design and selection of prostheses by reducing the compensatory motions required for common activities of daily living.

Thermo-mechanical Analysis of Porous Steel-based Catalyst Coatings with Microchannels

Presenter: Chen Chi

Finite element method is used on thermo-mechanical analysis of porous steel based catalyst coatings with microchannels. Thermo stresses of the microchannels due to temperature changes are obtained. The effects of microchannel geometry on themo stresses are studied in detail. The results revealed that in order to increase the performance of the catalyst coatings, interchannel distance, delaminated and nominal thickness must be optimized.

Bioconjugated Quantum Dots as Biomarkers for Early Cancer Detection

Presenter: Ganna Chornokur, Chemical and Biomedical Engineering
Contributors: Ostapenko, S.[1].; Oleynik, E.[1]; Phelan, C.[2]; Korsunska, N.[3]; Kryshtab, T.[4]; Zhang, J.[5]; Wolcott, A.[5]; Sellers, T.[2]
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We report on application of the bio-conjugated quantum dots (QDs) for “sandwich” enzyme-linked immunosorbent assay (ELISA) cancer detecting technique. A short-wavelength, “blue” spectral shift of the photoluminescence (PL) spectrum in CdSeTe/ZnS core/shell quantum dots (QDs) caused by bioconjugation with several monoclonal cancer related antibodies (ABs) was observed. The QD-AB conjugation reaction was confirmed using the agarose gel electrophoresis technique. Quantum dot ELISA detection of the cancer PSA antigen at concentrations as low as 0.01ng/ml which is ~50 times lower than the classic “sandwich” ELISA was demonstrated. Scanning photoluminescence (PL) spectroscopy was performed on dried ELISA wells and the results compared with the same QD samples dried on a solid substrate. The “blue” PL spectral shift magnitude up to 37 nm of conjugated QDs to PSA antibodies elevated in the “sandwich”-ELISA case in comparison with the same QDs, dried on the solid substrate. This effect is attributed to the complete washing out of nonconjugated QDs which does not contribute to the average PL of ELISA “sandwich”. The results can be used to lower “sandwich” ELISA levels of cancer antigen detection which may benefit both early cancer detection and forensic science.

Ag-Cu Alloy Nanoparticles for Metal Enhanced Fluorescence

Presenter: Sanchari Chowdhury, Chemical and Biomedical Engineering
Contributors: Venkat R. Bhethanabotla, Chemical and Biomedical Engineering; Rajan Sen, Civil and Environmental Engineering

Luminescence based measurements and devices are currently widely used methods in different fields such as biology, chemistry, materials science and medicine. Signal weakness due to low concentration of fluorophores attached with molecules and low photostability of molecular fluorophores are two major concerns for fluorescence technique. Using conducting metallic nanoparticles platforms, it is possible to enhance the quantum yield and photostability of weakly fluorescent probes by increasing their emission efficiency by modifying radiative decay rate or enhancing absorption rate. Surface plasmon resonance (SPR) wavelength, one of the most important properties of nanostructures, dictates the choice of materials to be used for fluorescence enhancement. By tuning the position of the SPR peak of the nanoparticles over a wide range of wavelengths, metal enhanced fluorescence (MEF) can be extended for a wide range of luminophores. Metal alloys offer additional degrees of freedom for tuning their optical properties by altering atomic composition and atomic arrangement. Large MEF was realized at the vicinity of easily fabricated Ag-Cu alloy nanoparticles upon tuning of their SPR spectra for maximum spectral overlap with the emission and absorption spectra of the luminophores. SPR wavelengths of these Ag-Cu nanoparticles were tuned in the visible and near infrared regions by changing only the annealing temperature. We observed strong emission enhancement of fluorophores (141.48 ± 19.20 times for Alexa Fluor 488 and 23.91 ± 12.37 times for Alexa Fluor 594) at the vicinity of these Ag-Cu nanoparticles, which is significantly larger than for pure Ag nanoparticles.

Augmenting Delivery of Plasmid DNA to Murine Skin In Vivo with Helium Plasma

Presenter: R. J. Connolly, Chemical and Biomedical Engineering
Contributors: G. Lopez; M.Hoff; M. Jaroszeski, Chemical and Biomedical Engineering

Delivering cell-impermeant therapeutic molecules, such as DNA, can be achieved through the use of chemicals, viruses, or physical forces applied directly to the targeted tissue. Chemical and viral delivery methodologies have been associated with deleterious side effects, such as cell necrosis and mutagenesis. In contrast physical forces do not introduce foreign materials into the body, which avoids many of the complications associated with viral and chemical delivery methodologies. This study investigated the use of helium plasma as a novel physical force for delivering plasmid DNA to murine skin in vivo. The delivery method included injecting the skin with plasmid DNA and exposing the skin surface to a helium plasma source to facilitate the entry of DNA into cells. The application plasma to the skin surface did not require contact between the skin and an electrical source as with traditional electroporation. In addition, no involuntary muscle contraction was observed during plasma treatment. Results from the delivery of plasmid encoding luciferase indicated that treatment of the injected area with plasma is capable of increasing the quantity of expressed luciferase by a factor of seven for an applied negative plasma relative to injecting the DNA alone. Similarly a six fold increase was achieved when positive plasma was applied for delivery. These findings illustrate that plasma could potentially compete with other delivery methodologies when the dermis is the targeted tissue.

Design of a Lightweight Wheelchair Mounted Robotic Arm

Presenters: Peter Schrock; Fabian Farelo, Mechanical Engineering
Contributors: K.J. De Laurentis; R. Alqasemi; R. Dubey, Mechanical Engineering

The design and testing of a wheelchair mounted robotic arm (WMRA) is presented in this poster for the purpose of helping people with disabilities in performing tasks which may otherwise not be possible. People confined to a wheelchair with limited or no upper limb usage have difficulty picking and placing objects, opening doors, and other activities of daily living (ADL), such as turning on a light switch. A WMRA has been designed to aid individuals with completing these daily tasks and to increase independence as well as quality of life. This is a design that builds upon previous WMRA research and incorporates research from industrial robot arms. There are many factors to be considered for WMRA design such as weight, speed, safety, cost, and types of tasks to be completed. The material and organization of the framework, the motors, harmonic drives, and control board have all been changed to improve the previous WMRA design. By utilizing carbon fiber as the main component for the structure or framework of the arm, the weight was reduced. Pultruded carbon fiber tubes are inexpensive, lightweight, and strong, which makes it a good material for the frame of the arm when considering the requirements of a mobile robot arm. Motors and harmonic drives were chosen to make the WMRA more aesthetically pleasing and potentially faster for task completion. A smaller more compact control board was used to improve communication and attachment to existing wheel chairs.

Control of a Wheelchair Mounted Robotic Arm

Presenters: Fabian Farelo, Mechanical Engineering;
Mayur Palankar, Computer Science and Engineering
Contributors: R. Alqasemi; K.J. De Laurentis; R. Dubey, Mechanical Engineering

A wheelchair-mounted robotic arm (WMRA) system was designed and built to meet the needs of people who have limited or no upper extremity mobility, and to exceed the capabilities of current devices of this type. The control of this 9-degree of freedom (DOF) system combines the 7-DOF robotic arm control with the 2-DOF power wheelchair control. This combination of the wheelchair and the robotic arm in a single control mechanism (user interface and software) allows people with disabilities to do many activities of daily living (ADL) that are otherwise hard or impossible to accomplish. The control system is designed for teleoperated or autonomous coordinated Cartesian control. The 3-degrees of redundancy are optimized to effectively perform ADLs and overcome some workspace limitations. Opening a door is the first targeted ADL to be performed by the WMRA. This activity combines both the teleoperated and autonomous coordinated Cartesian control to achieve the desired goal using redundancy optimization techniques. The system offers expandability for sensor assist functions and modular control for upcoming work. Additionally, the type of human-machine interface used for control is important since this can greatly increase the user’s ability to complete tasks in an efficient manner. The interfaces available for WMRA control include a graphical user interface through a touch screen laptop, a brain computer interface, and a multi-degree of freedom haptic device.

Atomic Force Microscopy Analysis of Central Nervous System Cell Morphology on Silicon Carbide and Diamond Substrates

Presenter: C. Frewin,[1] FMMD Scholar
Contributors: A. Oliveros[1]; M. Jaroszeski[2,5]; K. E. Muffly[3]; M. Peters[3]; E. Weeber[4,5]; S. E. Saddow[1,5]
[1]Electrical Engineering, [2]Chemical and Biomedical Engineering, [3]Pathology and Cell Biology, [4]Molecular Pharmacology and Physiology, [5]FCoE-BITT

Implantable brain-computer interface (BCI) devices to restore some functionality or enable rudimentary communication with incapacitated patients are currently designed from silicon (Si), a material which cannot withstand the harsh environment of the body. The devices must be protected from the body environment through the use of coatings, which inevitably increase the cell's distance from the electronically active areas on the device; thereby decreasing selectivity and sensitivity of the sensing device. Two alternative semiconductor materials are silicon carbide (SiC) and diamond. However, little work has been done to evaluate the general biocompatibility of the neuron with these substrates; our aim is to measure direct cell adhesion and subsequent cell proliferation on these substrate surfaces which are initial indicators of biocompatibility. Atomic force microscopy (AFM) was used to measure the morphology of individual neurological cells on cubic SiC (3C-SiC), nanocrystalline diamond (NCD), Si, and glass. We compared them to cells incubated on the control substrate of polystyrene. Two neural cell lines were used for this study; H4 human neuroglioma and PC-12 Rat pheochromocytoma. The substrate biocompatibility, via the ability of the substrate to support neural cell outgrowth, to these cell lines was evaluated by comparison of cell height/surface area, lamellipodia extension on the substrate, and MTT viability assays. 3C-SiC possesses a similar viability to polystyrene with both cell lines. Si and NCD have a good viability with the H4 cells, but show a lower value with the PC12.

A Multi-Agent Approach to Modeling of the Indiana Colorectal Cancer (CRC) Care System

Presenter: Chaitra Gopalappa, Industrial and Management Systems Engineering
Contributors: Tapas K. Das, Industrial and Management Systems Engineering; Selen Aydogan-Cremaschi, Chemical Engineering, Univeristy of Tulsa; Seza Orcun, e-Enterprise Center, Discovery Park, Purdue University

Performance of a population's cancer care system is dependent on the behavior of a number of independent decision making *agents*: Persona Agents (e.g., patients and physicians), Organizational Agents (e.g., hospitals and insurance companies), and Regulatory Agents (e.g., federal/state governments and FDA), whose goals could sometimes be conflicting. The objective of the research is to develop a prototype cyber-enabled multi-agent simulation decision model. A prototype framework constituting various agents of the system and interaction between agents will be developed to study system behavior. The prototype will be demonstrated on the Colorectal Cancer (CRC) care system of the State of Indiana and will serve as a decision tool for analyzing intervention strategies for early CRC detection. Current work stands at the development of probabilistic models representing the natural history of colon and rectum that comprises incidence of polyp and progression between stages on the CRC pathway. The probabilistic models serve as a basis for the simulation model. By varying decision strategies on the CRC care system its effect on the extent of intervention in population-wide CRC can be studied. Before testing intervention strategies, the probabilistic models

need to be validated. In order to do so, CRC incidence rates were obtained by simulating population of Indiana and validated against actual incidence rates. Work in progress includes modeling the treatment cycle for CRC. Further, physician agents will be modeled into the system to include evidence based practice compliance. In addition, modeling of the organizational agents will define the environment in which persona agents interact.

Database-centric data analysis of molecular simulation

Presenter: Vladimir Grupcev, Computer Science and Engineering
Contributors: Yicheng Tu; Ivan Dyedov, Computer Science and Engineering;
Sagar Pandit, Physics

Molecular simulations (MS) have become an integral part of molecular and structural biology. By providing model descriptions for biochemical and biophysical processes at nano–scopic scale, MS can provide fundamental understanding of diseases and help discovery of drugs. MS, by their nature, generate large amounts of data. Although many of the MS software are carefully designed to achieve maximum computational performance in simulation, they seriously fall short on storage and handling of the large-scale data output. The objective of this project is to use database technologies to improve the efficiency, ease of maintenance, and security of MS data analysis. We propose to accomplish this by developing novel data structures and query processing algorithms in the kernel of the database management system (DBMS), in addition to leveraging the advantages of such systems in their current forms. We focus on creative indexing and data organization techniques and query processing and optimization strategies. We believe that such innovations will bring significant intellectual merit from which both the biomedical and database management communities will benefit.

Design and Optimization of an Ion Funnel for a Macro-Molecular Patterning System

Presenter: Matthew Holland
Contributors: M. M. Beerbom[1]; P. Henze[1]; J.M. Anthony[2];Rudy Schlaf[1]
[1]USF Department of Electrical Engineering
[2]Elion Systems, Inc., Austin, TX

Directed assembly of nano-materials has remained one of the main challenges in nanotechnology applications. The presented research is part of a larger project to build a patterning device enabling the computer-controlled deposition of nano-materials in a vacuum environment. Electrospray injection is being used to transfer molecular ions into the vacuum directly from their solution environment. The ambient/vacuum interface is composed of differential pumping stages extracting the ambient gas and the solvent from the injected solution. During this process the ion beam needs to be collimated by means of ion optics to optimize ion transmission through the system.

In the first differential pumping stage at a pressure of about 1 Torr, this is achieved by means of an “ion-funnel”. The presented research showcases the design and performance of a RF-driven 100-lens ion funnel recently completed in our lab. The device achieves transmission rates of the order of 50% depending on the solution system used.

Destabilizing the Fibrillization Process of Aß Peptide: Implications to Alzheimer's disease

Presenter: Jeffy Jiménez, Chemical and Biomedical Engineering
Contributors: Nicole Hupalo; Norma Alcanzar, Chemical and Biomedical Engineering; David Morgan, Molecular Pharmacology and Physiology Department

Amyloid beta (Aß) is a peptide recognized as the main component of neuritic plaques in Alzheimer's disease (AD) brain's patients, primarily $Aß_{1-40}$ and $Aß_{1-42}$ peptides. These plaques are an important hallmark in the disease. Patients with AD suffer of memory loss, coordination, speech, rezoning, and show perturbed social behavior. Our work focuses in the study and characterization of the physicochemical phenomena responsible for the aggregation and dissolution processes of Aß peptides under different media conditions. We used mainly two analytical techniques: atomic force microscopy (AFM) to monitor the peptide's morphological change and attenuated total reflection Fourier infrared (ATR-FTIR) spectroscopy to assess its molecular rearrangement with time. Our results show a link between the peptide's morphological change and its molecular rearrangement (in terms of secondary structures: α-helix, ß-sheets, and ß-turns) during the formation and dissolution of aggregates, over time. Our spectroscopy results suggest that the α-helix secondary structures drive the process of aggregation while ß-sheet structures reach a steady state over time. These results are now being used to understand and optimize the effects of different antibodies on aggregates to treat Aß plaque formation. The outcomes of this work will provide a scientific understanding of the AD plaque formation process and its removal using antibodies that target Aß aggregates for future AD treatments.

Actuation and Fracture of Compliant MEMS Devices

Presenter: Ke Du, Mechanical Engineering
Contributors: A.A. Volinsky; Craig Lusk, Mechanical Engineering

Compliant Mechanisms are widely used in our daily life. The application of compliant mechanisms at the micro and nano scales has recently drawn great attention. Compliant MEMS devices with fewer joints and springs may have longer life than traditional MEMS devices. In this report, we tried to actuate a compliant MEMS device using the Hysitron Triboindenter with a blunt conical tip. It has been found that the device slider disconnected with the four-bar mechanism can be actuated. However, when we connect to the four-bar mechanism, the nanoscratch always induces a crack at the edge of the sliders. High friction forces in the slider might be the main reason for the observed fracture.

Microneedle Based Biofluid Collection System to Aid Battlefield Trauma Sensors

Presenter: Puneet Khanna[1]
Contributors: Brenda R. Flam[2], Barbara Osborn[2], Joel A. Strom[2,3], Shekhar Bhansali[1]
[1]Electrical Engineering, [2]Internal Medicine, [3]Chemical and Biomedical Engineering

Battlefield trauma triage and prognosis often calls for early detection of early appearing biomarkers in biological fluids. In the battlefield, the detection equipment cannot be unwieldy and its usage protocol has to be convenient. A biofluid collection system based on microneedles offers the advantage of being unobtrusive and conducive to development of automated sensors requiring minimal human intervention. In this study, a prototype biofluid acquisition system has been developed which can be adapted to on site/field usage to collect biological fluids for candidate biomarker measurements. The acquisition device consists of silicon dioxide microneedles and a glass cap for fluid collection. The microneedles and the glass biofluid collection chamber have been successfully fabricated. A microneedle insertion setup has been built using micro-manipulators to enable precise insertion and testing of microneedles into skin. Finally, insertion tests in human skin have been conducted to validate successful fluid transfer.

Maximum Temperature Measurement Technique by Irradiated 3C-SiC Single Crystals

Presenter: Viacheslav Kuryachiy

Abstract not available.

In Situ Nanomanufacturing Process Control for Repeatability Improvement

Presenters: Gang Liu, Industrial and Management Systems Engineering
Contributors: Q. Huang, Industrial and Management Systems Engineering;
S. Kumar, Mechanical Engineering; S. Bhansali, Electrical Engineering

This poster aims to investigate correlation mechanism among functional process variables (FPVs) for condition monitoring in chemical-mechanical planarization (CMP). During wafer polishing, critical process variables such as coefficient of friction (COF) and pad temperature vary with time and present in the shape of functional curves. Our previous work has demonstrated that correlation patterns among these FPVs could be related to polishing conditions. Since correlation is affected by both amplitude fluctuations and phase variability in FPVs, further study of timing correlation of FPVs measured in different units could bring more insights into physical interactions and thereby enhance CMP condition monitoring. Existing research on FPVs in CMP mainly focuses on individual effects of FPVs and statistical correlations through experimental and theoretical analyses. In this paper, we intend to specifically reveal the timing correlation patterns in CMP. Using nonlinear dynamics, we first established a dynamic phase model to define the strength and patterns of FPV interaction. By monitoring the extracted patterns, we then developed a novel method of detecting CMP condition change and demonstrated the approach via a CMP experiment. The results showed that the proposed method has a promising application in identifying the process changes that may not be easily detected otherwise.

Silicon Carbide for Advanced Biomedical Applications

Presenter: A. Oliveros,[1] USF SiC Group
Contributors: C. Frewin[1]; N. Schettini[1,6]; C. Coletti[1,2]; S.E. Saddow[1,6]; M. Jaroszeski,[3,6]; K. Muffly[4]; E. Weeber[5]
[1] Electrical Engineering, [2]Max-Planck-Inst., Stuttgart, DE, [3] Chemical and Biomedical Engineering, [4] Pathology and Cell Biology, [5] Molecular Pharmacology and Physiology,
[6] FL Center of Excellence for Biomolecular Identification and Targeted Therapeutics (FCoE-BITT)

Man-made devices to perform surgery, diagnostics or bio-sensing in the human body require electrical components and therefore demand the integration of inorganic materials with living tissues and biological compounds. Currently, silicon (Si) is the leading semiconductor for such applications. However, for certain *in vivo* applications, it has proven to be biologically incompatible, susceptible to biofouling, as well as material degradation from cellular processes which can then suffer necrosis [1]. In the recent years, the search for materials to build devices that can be implanted in the human body, as well as capable of operating under long term physiological conditions, has become a priority. The USF SiC group is pioneering the use of SiC (silicon carbide) for advanced biomedical applications. This includes most major systems within the human body, such as skin, bone, cardiovascular and neuronal systems. Our studies include skin and bone cell proliferation on SiC, research on SiC hemocompatibility to determine mechanisms for blood chemistry sensors and neural cell attachment and electrical communication with SiC. SiC is a material with multifunctional properties and is mechanically robust, inert to biological tissue, non-toxic and biocompatible [2]. Results to date evidence the suitability of using SiC as a semiconductor material for implantable biomedical devices. In particular the experiments performed with neuronal cells show a high degree of viability on SiC compared to Si without degradation of the Si surface after cell removal In fact SiC appears to be both biocompatible and hemocompatible making it an ideal man-made material for biomedical interfacing applications.

Reliability Modeling of Gate Dielectric Films of Ge Metallic Oxide Semiconductor (MOS) Devices

Presenter: W. Otieno, Industrial Engineering and Systems Management
Advisor: G. Okogbaa, Industrial Engineering and Systems Management

The National Academy of Engineering recently identified several 21st Century Science and Engineering Grand Challenges, which include the need for innovations in: energy, health care and health informatics, environment protection, personalized learning, cyberspace security, virtual reality and tools for scientific discovery. This research will contribute to these challenges by providing an understanding of the inherent failure characteristics of metal/high dielectric gates, and hence the reliability of Metallic Oxide Semiconductor (MOS) devices, such as memory chips. While the successful fabrication and incorporation of metallic oxides in transistors was a significant achievement in the electronics industry, the progressive scaling of transistors has had severe reliability implications and challenges. The reduction of the transistor size has resulted in the scaling of gate dimensions, and of particular concern is the dielectric thickness to less than 2nm. Such ultra thin dielectric films tend to lose their ability to insulate at higher gate voltage, resulting in short channeling effects, increased current leakage and increased power dissipation, which is evidenced when memory chips malfunction in electronic devices. The objective of our research is to overcome gate dielectric reliability challenges of recently developed GE MOS devices. This will be accomplished through the following innovations: the identification of the failure mechanisms of Ge-based high-k gates; development of appropriate failure data collection schemes that will consist of electrical measurements on MOS devices such as gate leakage at elevated gate voltage and electric charge levels. Finally we will apply statistical computation tools to model the reliability of gate dielectrics.

Augmenting Delivery of Plasmid DNA to Murine Skin In Vivo with Helium Plasma

Presenter: JI Rey, Chemical and Biomedical Engineering
Contributors: RA Gilbert; MJ Jaroszeski; AJ Llewellyn, Chemical and Biomedical Engineering; F Moussy, Institute for Bioengineering, Brunel University, West London, UK

In vivo electroporation is a proven method that can be used to selectively bioengineer living tissues by inserting transgenes within plasmid vectors; these genes then serve as a blueprint for cells to express the desired proteins. By inserting a gene for Luciferase, a bioluminescent tracer protein into the target tissue we evaluated the effectiveness of different in vivo electroporation parameters. In this project we used multiphysics finite element (FEM) modeling to design an in vivo electroporation applicator that will work in accordance with an implantable glucose biosensor and its surgical implantation protocol to produce the desired targeted neovascularization protein expression that can result in improved long term function of the biosensor. The next goal of this project involves the substitution of the tracer gene with potent neovascularization

Reconstruction of Transcriptional Networks of Shewanella

A. M. Rocha[1], K. Guruprasad[2], P. G. Stroot[1], and N. Samatova[2,3]
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Advances in genome-based microbial studies, has led to development of a number of network inference algorithms for understanding microbial cellular processes. These algorithms are important in understanding and identifying potentially important microbial responses to environmental perturbations. Together, with traditional experimental growth studies, these predictions may play a critical role in developing and implementing bioremediation strategies. In this study, we evaluate the use of two network inference algorithms, the cMonkey and context likelihood of relatedness, studies for predicting transcriptional gene responses in microorganisms. To evaluate these approaches we re-constructed transcriptional regulatory networks of *Shewanella oneidensis* MR-1, a potentially important microorganism for bioremediation studies. Transcriptional regulatory networks were constructed using annotated genome sequences for 162 transcriptional genes and known network associations. Gene expression data for 245 conditions were selected from Tim Gardner's M^3Database. To identify network interactions, expression and gene datasets were incorporated into corresponding global datasets for each algorithm. Due to the ability of these models to integrate computational and experimental data on a global level, it is expected that both programs identify known and potentially novel relationships among regulatory networks for *S. oneidensis.* Identification of both regulatory motifs and co-regulated gene cluster will be used to generate specific hypothesis regarding regulatory response of *Shewanella* to environmental factors in natural habitats.

A Novel Optimization Computerized scheme for Efficient Lung Cancer Diagnosis using Computed Tomography

Presenter: Ravi Samala, Electrical Engineering
Contributors: Wilfrido Moreno, Electrical Engineering;
Yuncheng You, Mathematics and Statistics; Wei Qian, College of Medicine

An analysis for optimum selection of image features in feature domain to represent lung nodules is performed with implementation into a classification module of a Computer Aided Diagnostic (CAD) system. Non-parametric correlation coefficients, multiple regression analysis, principle component analysis (PCA) were used to map the relation between the represented features from 4 radiologists and the computed features of a Computed Tomography (CT) imaging modality. Artificial Neural Network (ANN) is used for classification of benign and malignant nodules to test and improve on the hypothesis obtained from the mapping analysis. Correlation coefficients ranging from 0.2693 to 0.5178 were obtained between the radiologist's annotations and the computed features. Out of the 11 features used, 3 features were found redundant when both nodule and non-nodule cases were used and 5 features were found redundant when nodule or non-nodule cases were used. Combination of analysis from correlation, regression, PCA and ANN resulted in selection of optimum features to achieve highest F-test values of 0.821 and 0.643 for malignant and benign nodules respectively by using 4 features. In conclusion, CAD developers should not include features depending on various analyses oriented towards radiologist annotations alone. In addition, features should be analyzed individually and collectively to evaluate the impact that they have on the CAD system based on their class representation. This methodology will ultimately aid in improving the generalization capability of a classification module to aid early lung cancer diagnosis.

Sensitivity Enhancement of MALDI Mass Spectrometry Measurements using H2O-Insoluble Matrix Compounds

Presenter: J. Schumacher, Dept. of Electrical Engineering
Contributors: J. Koomen, Moffitt Cancer Center; R. Schlaf, Electrical Engineering

Matrix-assisted laser desorption/ionization (MALDI) is a soft ionization technique used in mass spectrometry of large molecules including biomolecules. This preparative technique requires a proton-donating matrix to be co-crystallized with the analyte of interest. A solution containing the matrix and analyte is drop-deposited onto a sample plate, where a crystalline deposit is formed after solvent evaporation. The sample is desorbed and ionized with a focused UV laser beam inside a mass spectrometer.

One of the issues of this technique is formation of irregular crystalline deposits which increase measurement variability. Furthermore, the laser spot is smaller than the deposit, making it necessary to interrogate various crystals of the deposit until a good signal is found. The objective of the presented research is the development of a nanostructured substrate for droplet anchoring and lateral deposit concentration for analyte/matrix mixtures of non-water soluble compounds similar to anchor plates available for water-soluble matrix compounds.

The presented results demonstrate well-defined lateral concentration of analyte/matrix crystals into an area of approximately 150 micron diameter (equal to the laser spot diameter), and signal-to-noise improvements in the range of 3x to 50x, depending on experimental parameters.

Surface Conditioning and Material Interactions in 4H-SiC

Presenter: Eugene L. Short[1]
Contributors: Elena I. Oborina; Helen N. Benjamin[2]; Andrew M. Hoff, Electrical Engineering
[1] USF Graduate Multidisciplinary Scholar; [2] USF Sloan Scholar

Functional surface conditioning treatments for optimized electronic properties of semiconductor surfaces have been a central theme in electron device manufacture for decades. Examples include the classic RCA clean, high temperature hydrogen etching, and plasma treatments. Two unique USF capabilities are utilized in this work to demonstrate the impact of plasma afterglow conditioning treatments of 4H-SiC, silicon carbide, epitaxial layers compared to wet or gas phase chemical treatments. Noncontact corona-Kelvin metrology of wide bandgap semiconductors, C-KM, is used to compare the electronic response of n-type 4H-SiC material to these treatment conditions. Flowing afterglows emanating from a microwave cavity plasma are rich sources of neutral radicals, atomic, and excited molecular species. Semiconductor substrates, held at a prescribed temperature in this environment, may be treated with a high mass flux of a tailored chemistry of neutral afterglow species.

As compound semiconductor processing and substrate technologies mature, fast in-line metrology methods may provide electronic parameter details that are key for optimized manufacture. C-KM is an accepted method in the silicon IC industry and is being developed for use by the SiC community in our laboratory. In each experimental sequence, n-type 4H-SiC epitaxial films were processed through RCA clean, followed by combinations of thermal and afterglow processing. Distributions of effects across 3 inch wafers were studied using temporal and spatial C-KM data from a 5 point measurement pattern. Dramatic electronic differences in process response were observed.

Comparison of Sit to Stand Motion of Prosthetic Knees

Presenter: Francy L. Sinatra, Mechanical Engineering
Contributors: S. Carey; D. Lura; R. Dubey, Mechanical Engineering;
M.J. Highsmith, School of Physical Therapy and Rehabilitation Sciences

Many studies have used motion sensor equipment to acquire gait information. This study evaluates the task time and ground reaction forces of patients that use a prosthetic knee. While using the VICON infrared light cameras, we have collected the kinetic profile of various lower limb prostheses specifically the performance of the knee component. We gathered three trials for each individual, while they were sitting down and standing up. Ten subjects with unilateral transfemoral amputations were studied, five of which were C-leg users and five were Polycentric knee users. After analyzing the data, the average ground reaction forces and the average time it took each person to complete each trial was extracted. It was observed that all patients had great difficulty while sitting and standing. As observed in the data, the prosthetic users placed most of their body weight on their sound leg while performing the task. The user would make unusual compensation while standing by using the prosthetic leg as a pivot point. It was also noted that the amputees would take twice as long to either sit or stand as an individual using no prosthesis. While the Polycentric knee and C-leg users had similar traits, the Polycentric knee users placed eighty seven percent of their body weight on their sound leg while C-leg users placed seventy five percent of their body weight on their sound leg. The study experimentation and results are presented in this poster.

Deposition of E. coli 0157:H7 Biosensor Coupons with Electrospray

Presenters: Matthew Spaulding; Eric Tridas, Electrical Engineering
Contributors: Sonia Magaña; Daniel Lim, Biology; Mark Anthony, Elion Systems, Inc., Austin, TX; Rudy Schlaf, Electrical Engineering

Recent concerns over food safety and potential bio-terrorism threats have made ubiquitous deployment of biosensors an urgent challenge. Large-scale use will require substantially more cost-effective and reliable manufacturing techniques for bio-sensor coupons (single use "chips", which immobilize the pathogen in question for further analysis. The current method used for producing E. coli biosensors is expensive and time consuming. Currently, a solution-based process is used where glass slides are immersed for extended periods of time (hours to days) in a number of solutions. Using electrospray, this process can be accomplished in only a matter of minutes and with less material waste, hence offering the potential for industrial manufacturing schemes. Electrospray thin film deposition is a method where molecules (antibodies in our case) can be deposited directly from solution with a high degree of control. This project focuses on the exploration of various parameters of the electrospray process, and the correlation of these parameters to the resulting thin film morphology and sensing effectiveness and specificity. The prepared samples were tested using E. coli O157:H7 and salmonella pathogens (as control for specificity testing). The presented experiments demonstrated that electrosprayed biosensors have equal or better sensitivity than sensor coupons produced with the standard wet-chemical technique.

Are We Ready to Fight a "Bird Flu"? A Novel Approach to Mitigate Cross-Regional Pandemic Outbreaks

Presenter(s): Andres Uribe, Diana Prieto, Alex Savachkin, Tapas K. Das, Department of Industrial & Management Systems Engineering
Contributors: Yiliang Zhu, College of Public Health

Given an ominous expectation of a potential impact that a "bird flu" pandemic can have on the U.S., and associated limitations of existing decision aid models available for policy makers, development of efficient pandemic mitigation strategies is considered a national need. We present a methodology to develop mitigation strategies for cross-regional pandemic outbreaks using a simulation-based optimization model. The cross-regional simulation incorporates implementation of vaccination, antiviral application, and social distancing for each affected region, and consider a broad set of outcome measures, including the cost of lost productivity and medical expenses. The simulation embeds a dynamic cost-based optimization model to generate federal mitigation strategies. The model is implemented on a four-region outbreak in Florida and the resulting mitigation strategies are compared to existing governmental pro-rata distribution policies.

Functionalized Nanomaterials for DNA Sensing

Presenter: J. Weber, Mechanical Engineering
Contributors: R. Joshi; A. Kumar, Mechanical Engineering;
S. Pillai; S.R. Singh, Alabama State University

The fabrication of DNA nanotubes attached to gold nanoparticles has been achieved by means of a facile, electrochemical technique. The simple approach has been utilized to construct the DNA nanotubes by implementing the concept of applying a suitable DC-bias to DNA-Gold plating solutions. DNA nanotubes are self-assemblies of DNA and are stable at room temperature for many days. These nanotubes are expected to be highly efficient genosensors. Similarly, a nanoscale molecular sensing device has been designed and developed for the detection *Salmonella enetrica* serovar Typhimurium. Our device has been fabricated to detect very low levels of *Salmonella* by attaching single stranded DNA (ssDNA) specific to *Salmonella* to carbon nanotubes (CNTs), which are aligned vertically and attached to a gold microelectrode. The carbon nanotubes have been modified with different functional groups (i.e. carboxylic acid, thiol) to facilitate hybridization of the DNA. These nanotubes have been chemically assembled onto the surface of a gold quartz piezoelectric crystal. Several techniques were used to characterize the DNA electrode, including AFM, SEM, Raman spectroscopy and electrochemical methods.

Smart Packaging: A Novel Technique for localized Drug Delivery for Ovarian Cancer

Presenter: Eva Christabel Williams, Chemical and Biomedical Engineering
Contributors: Ryan Toomey; Norma Alcantar, Chemical and Biomedical Engineering

In this project, we have developed a model drug delivery system consisting of non-ionic surfactant vesicles (niosomes) packaged within a biodegradable, temperature and pH sensitive hydrogel network. We have characterized the behavior of individual niosomes when exposed to environments that mimic body fluids. Diffusion and mass transfer characteristics of 5,6-Carboxyfluorescein, a dye with similar physical properties as therapeutic drugs for cancer, is used to determine release rate from the niosomes. The release rate can be controlled to last from 24 hours to more than 144 hours depending on the conditions to which individual niosomes are exposed. We used a cross-linked hydrogel (chitosan) network into which the niosomes were embedded. The hydrogel provides another layer of control, gives a stable environment for the niosomes, and enhances the release rate. The niosome-hydrogel system, which is a liquid at room temperature, starts gelling once inside the body since it undergoes a phase transition at 37ºC. Surface characteristics, such as the interaction between the niosomes and chitosan, Van der Waals forces and chemical bonding are being measured by the Surface Force Apparatus (SFA) technique. Release rate studies *in- vitro* proved that drugs continued to be released appreciably even after 3 months of the experiment. Our results will help in the development of a low cost and improved method for drug delivery with application to intracavitary ovarian cancer treatment and other cancer types.

Nonlinear Dynamics Modeling of Correlated Functional Process Variables for Condition Monitoring in Chemical-Mechanical Planarization

Presenter: Xi Zhang, Industrial and Management Systems Engineering
Contributors: Q. Huang, Industrial and Management Systems Engineering;
S. Kumar, Mechanical Engineering

In semiconductor manufacturing process, the correlation patterns indicating interaction structures among those critical functional process variables (FPVs) could be related to the process conditions. Study of timing correlation of FPVs measured in different units could bring more insights into physical interactions and thereby enhance process condition monitoring. Nonlinear dynamic model was established to reveal the timing correlation patterns, and advanced statistical tools were employed to monitor manufacturing process.

Underwater Repair of Corroding Piles Incorporating Cathodic Protection

Presenter: Julio Aguilar, Civil and Environmental Engineering
Contributors: D. Winters; R. Sen; G. Mullins; M.Stokes, Civil and Environmental Engineering

Fiber reinforced polymers (FRP) are light weight, high strength corrosion resistant materials that are ideally suited for the repair and rehabilitation of concrete structures. This study develops and extends the application of FRP to repair corrosion-damaged reinforced and prestressed concrete elements by incorporating an embedded cathodic protection system within the repair. Additionally, it adapts vacuum bagging and pressure bagging techniques used by the composites industry to improve the FRP-concrete bond.
A prototype system developed in the laboratory is being implemented in a field demonstration project in which four reinforced concrete piles supporting Piers 103 and 104 of the Friendship Trail Bridge in Tampa Bay will be repaired.

Algorithms and Architectures for Improving the Reliability of VLSI Circuits

Presenter: Bhattacharya Koustav

We investigate several algorithmic and architectural techniques for increasing the robustness of hardware implementations of computing systems against reliability threats predominantly involving soft errors. Transient faults, such as soft errors, occur when the energetic neutrons coming from space or the alpha particles arising out of packaging materials hit the transistors. A soft error may manifest itself as a bit flip in a latch or memory element. Towards this we describe several architectural strategies for protecting processor L2 caches against multi bit soft errors at negligible overheads in delay, power and area. Additionally, due to shrinking feature sizes soft errors can occur also in any internal nodes of a combinational logic and subsequently propagate to and be captured in a latch. Towards this we have developed develop circuit structures that can be selectively inserted on nodes in a combinational structures for significant reduction in soft error rate with low overheads. Further, to counter growing tend in wiring densities that leads to higher coupling noise and increasing impact of process variations, we have developed a multi-metric gate sizing formulation at the logic level that simultaneously optimizes the circuit for delay, power and reliability issues like crosstalk noise and radiation induced soft errors under process variations. Results for the various proposed strategies indicate significant reductions in soft error rate, crosstalk noise with negligible penalties in delay, power and area while not compromising timing yield losses due to parametric variations.

Managing Energy Use in a Network with a New SNMP Power State MIB

Presenter: Francisco Blanquicet, Computer Science and Engineering
Contributor: Ken Christensen, Computer Science and Engineering

Energy consumption has become a major factor in the total cost of ownership (TCO) of IT equipment. The power state of IT equipment is effectively “invisible” to the network making it difficult to measure or control energy use. In order to reduce the energy use of IT equipment, there must be a means of monitoring and controlling it. We have proposed, prototyped, and evaluated a new SNMP Power State MIB and its agent to expose equipment power state to the network.

Elliptic Curve Cryptology based Access Control in WSNs and Global Wireless Sensor Networks (WSNs)

Presenters: Ismail Butun and Bill Phillips, Electrical Engineering
Contributor: Ravi Sankar, Electrical Engineering

Security in WSNs is a challenging issue because security solutions for wired or cellular networks are ineffective for WSNs. This is due to some constraints that exist in WSNs such as battery power constraint (computational and communicational energy consumptions), memory constraint and reliable router constraint. Therefore it is essential to provide an *Access Control* for end-users of WSN applications that will ensure access to the monitored data for authorized parties only, and will support user-friendly data queries. I will also DoS (Denial of Service) resilient to save the sensors' battery capacity. We propose to achieve these by issuing Elliptic Curve Cryptography (ECC). In information security, ECC is an innovative algorithm which does not only bring increased security but also decreased key lenghts compared with the other cryptography algorithms. With our algorithm we propose to obtain a better performance for the WSN Access Control in terms of processing times by issuing ECC.

Global problem solving requires global information sharing. Low cost sensor technology has enabled the world-wide deployment of heterogeneous sensor networks offering complementary sensor data. In order to achieve accurate modelling of complex physical phenomena, it is necessary to combine multiple sensor measurements, in dense configurations, spanning an array of scientific disciplines. The solution to this dilemma involves collaborative sharing of real-time data observations through a Global Sensor Network (GSN) with participants from governmental organizations, educational institutions, military establishments, and commercial ventures. This study addresses some of the more formidable challenges involved in implementing a comprehensive network.

Towards Automated Surveillance in Public Transit Systems

Presenters: Joshua Candamo; M. Shreve, Computer Science and Engineering
Contributors: D. Goldgof, Dept. of Computer Science and Engineering; D. Sapper, Center for Urban Transportation Research

Visual surveillance is an active research topic in computer vision. Public transit systems are actively seeking new or improved ways to use technology to deter and respond to accidents, crime, suspicious activities, terrorism, and vandalism. Suspicious behavior recognition algorithms, for both humans and vehicles, can be used proactively for prevention of incidents, or reactively for investigation after the fact. Our work includes a detailed review of current state-of-the-art methods for automatic behavior recognition techniques, with a focus on surveillance of operationally relevant activities in the context of transit applications. Additionally, we survey the capabilities of commercially available analytics systems in contrast to the research literature. Also, we completed a security census of Florida's large transit agencies; in order to emphasize the lack of state-of-the-art technology being used in public transit surveillance, analyzing weaknesses and possible future directions.

Feature Selection for Microarray Data by AUC Analysis

Presenter: J. Canul-Reich, Computer Science and Engineering
Contributors: L. Hall; D. Goldgof, Computer Science and Engineering;
S. Eschrich, Biomedical Informatics at Moffitt Cancer Center and Research Institute

Microarray datasets are usually limited to a small number of samples and a large number of gene expressions. Hence, dimensionality reduction through a feature/gene selection process is highly important for classification purposes. In this poster, the feature perturbation method (FP) we previously introduced is applied on microarray data for gene selection. Experiments were conducted using a publicly available colon cancer dataset. In comparison with SVM-RFE, FP is better with feature sets of between 10 and 80, however for less than 10 features SVM-RFE results in higher accuracy. In order to determine the proper amount of noise to be applied, an analysis of the area under the curve of the feature perturbation method for the top 50 and 25 features is performed. We show that a good set of small features/genes can be found using the feature perturbation method.

Performance of Rapid Tooling Molds for Thermoformed Sockets

Presenter: J. Chimento, Mechanical Engineering
Contributor: N. Crane, Mechanical Engineering

Traditional prosthetic socket fabrication is a laborious and time consuming process that involves physical measurements of the stump, plaster wrapping and casting for mold preparation, and a thermoforming process. During the mold preparation stage, significant modifications are performed subjectively based on prosthetist's experience aiming to transmit an optimum load to the prosthesis through the socket. Rapid Prototyping techniques have advanced rapidly during the recent decades emerging as an alternative for Computed Aided Socket Design which promises a reduction in the fabrication time. In addition, 3D scanning provides a faster and accurate virtual replica of the stump which can be imported in CAD environments that enhance the ability to perform modifications precisely and store files indefinitely. This work examines the potential use of ZCorp 3D printers to directly manufacture the thermoforming mold from 3D scan data. The performance of ZCorp molds socket based on two main parameters: pneumatic permeability and flexural strength. The traditional material for mold casting, Plaster of Paris, is compared to materials used for three dimensional printing by ZCorp printers: zp130 untreated and zp130 Cyanoacrylate (CA) infiltrated, zp140 untreated and zp140 water cured. To obtain the flexural strength of the different materials three point bend tests were performed using ASTM Standard D790-03 requirements. In addition, pneumatic permeability tests were performed following ASTM Standard D6539-00.

Characterization the Microwave Properties of SU-8 Based on Microstrip Ring Resonator

Presenter: J. Dewdney, Electrical Engineering
Contributor: J. Wang, Electrical Engineering

SU-8 is a negative photoresist, epoxy type, commonly used within MEMS area such as microfluidics,advancing packing and optoelectronics. In spite of the widely use of this material, its electrical properties such as dielectric constant and tangent loss have been only investigated at lower frequencies in the range of hundreds of megahertz.

This poster presents a novel method for characterizing the microwave properties of the SU-8 epoxy using a microstrip ring resonator (MRR). In the presence of overlay on the surface of the MRR, a change in the effective dielectric constant of the system that can be accurately detected by measuring the shift in the resonance frequency of the MRR. In addition, the *Q-factor* of the system is affected, due to the losses introduced by the overlay, from which the loss tangent of the material can be extracted. A novel technique knows as flow coating is used to deposit the polymer material on the top of the MMR, this technique eliminates issues presented with conventional spin coating such as edge bead and is not limited to circular-shape and rigid substrates.

S-parameter measurements using a vector network analyzer are performed in order to determine the value of the dielectric constant of the material as a function of the shift in the resonance frequency of the MMR and the thickness of the overlay layer. The design procedure, fabrication process and parameter extraction are detailed in this poster.

Detection of Marine Vehicles on Horizon from Buoy Camera

Presenter: Sergiy Fefilatyev, Computer Science and Engineering
Contributors: Dmitry B. Goldgof, Computer Science and Engineering;
Chad Lembke, Center for Ocean Technology

This work presents a novel technique for automatic detection and tracking of marine vehicles in video of open sea. The source of video is a video camera mounted on a buoy platform in open sea. Such system is intended to work autonomously, taking video of the surrounding ocean surface and analyzing them on presence of marine vehicles. The proposed technique is based on detection of marine vehicles in individual video frames and tracking the detected targets through the video sequence with the help of a tracking algorithm. Several performance metrics are utilized for performance evaluation of the proposed approach. Accuracy of detection in 90% range is shown on a dataset of 30 short video sequences taken by a prototype of the system.

Automated Recognition of Sign Language Patterns

Presenter: Jayapragas Gnaniah, Special Education;
Contributors: Ruiduo Yang; Sunita Nayak;
Sudeep Sarkar, Dept. of Computer Science and Engineering;
Barbara Loeding, Special Education

Sign languages are complex, abstract linguistic systems, with their own grammars, and their ``articulation'' involve not just the hands, but the face, shoulder, and arms. We are exploring and pushing the state of the art in scalable automated American Sign Language (ASL) recognition formalisms. Presently, there are methods to recognize isolated signs and, to some extent, continuous signs in short sentences from a single signer, mostly using special equipment such as data gloves or magnetic markers or from visual input against plain background and special clothing. This project is pushing the frontiers in ASL recognition along the following major scientific directions: (i) recognition in varied backgrounds and different clothing, (ii) use of non-manual aspects such as facial expression and head movement, (iii) and design of robust, scalable formalisms. We are also looking into the design of automated ASL learning systems based on camera feedback.

Synthesis, Characterization and Applications of Nanocrystalline Diamond Films

Presenter: Humberto Gomez[1]
Contributors: Srinath Balachandran[2], Sathyaharish Jeedigunta[2], Ashok Kumar[1], Tom Weller[2]
[1]Department of Mechanical Engineering
[2]Department of Electrical Engineering

The importance and interest of diamond synthesis is based on the unique properties that can be achieved using this material in several applications. Diamond films with smaller gain size often referred to as "Nanocrystalline diamond" have a smooth surface, more grain boundaries, less highly oriented grains and better electron emission properties. Besides, better electrical conductivity (grain boundaries appear to conduct) and better tribological properties, it can find applications in MEMS and other electronic and mechanical applications. Nanocrystalline diamond films (NCD) were grown on silicon (100) and WC-Co substrates by microwave plasma chemical vapor deposition MPCVD using CH4/Ar/H2 gas chemistry at a pressure of 135 T, M. W. power of 1.8kW and a substrate temperature of 750 °C. The structural properties were characterized by SEM, TEM, Raman spectroscopy and NEXAFS. Several MEMS structures that include thermally actuated cantilevers and fixed beams, and free standing diamond windows have been fabricated. The diamond bridges were integrated to realize tunable switches and inductors using a solid-liquid interdiffusion process. Small signal and high power measurements were made in the frequency span of 1-30 GHz and 24-47 dBm respectively. Apart from the above mentioned electrical applications, NCD films have been deposited for cutting tool materials applications. This research is supported from NSF NIRT grant # ECS 0404137.

Optimization Models to Identify Protein Biomarkers for Ovarian Cancer Diagnosis

Presenters: Gopalappa, Chaitra; Martínez, Dayna,
Industrial and Management Systems Engineering
Contributors: Das,Tapas; Savachkin, Alex, Industrial and Management Systems Engineering; Stuphen, Rebecca, College of Medicine

Ovarian cancer is the leading cause of gynecologic cancer deaths among American women according to the American Cancer Society. The reason is attributed to the fact that most cases get diagnosed at late stages of cancer at which point chances of successful treatment are very low.. Currently, there is no effective non-invasive method to screen for ovarian cancer. Surgery is the only reliable way to distinguish between benign and malignant disease, resulting in several unnecessary surgeries. The objective of this research is to develop an optimal biomarker prediction model to diagnose ovarian cancer. The model will help develop strategies for detection that can be both highly accurate and minimally invasive. Protein Fractionation- 2 Dimension (PF2D) is a system of hardware, software and chemistry that can be used to identify protein levels from both urine and blood samples. However, there are major challenges in analyzing the data resulting from PF2D. Some of these challenges are removal of noise, baseline correction, spectra normalization, peak extraction, protein biomarkers identification and finally pattern generation for classification. For this research, PF2D data from 10 urine samples of cases paired with their corresponding controls are being analyzed. We address the above mentioned challenges by developing optimization and data mining models that can efficiently classify cases and controls.

Signal Identification for Cognitive Radio

Presenter: Ali Gorcin, Electrical Engineering
Contributors: H. Arslan, Electrical Engineering

One of the most important aspects of cognitive radio (CR) is that it proposes methodologies to increase current spectrum efficiency. One way is to let the secondary users to unused parts of the spectrum for a given geographical space, at a certain time. This requires certain knowledge on the characteristics of the communications. If the signal types and communication technologies existing in the area are identified, then it will be possible to determine how to let the secondary users communicate through the medium in a safe, reliable way with high quality of service and, without interfering and harming the primary users' communication. Secondly, if the signal type of the primary user is known, alternative methodologies can be applied to allocate the secondary user. Finally, regulation commissions have restrictions on some of the frequency bands indicating the type of the signal for that band. Intruding signals, which are not expected in the frequency band, can also be identified using signal identification. Several methodologies proposed previously for signal detection under spectrum sensing concept, however the concerns of these methodologies are to detect a signal in a given frequency spectrum but not to identify the signal or communication technology. Within this paper, application of a recursive algorithm for wireless radio signal identification is introduced. Classification of the wireless signals, bandwidth, center frequency and power level, etc. information about the occupant wireless signals are estimated be given within some statistical information about the monitored frequency spectrum.

MR Brain Image Segmentation

Presenter: Yuhua Gu, Computer Science and Engineering
Contributors: Larry Hall; Dmitry Goldgof; Prodip Hore,
Computer Science and Engineering

Magnetic resonance imaging (MRI) is an imaging technique used primarily in medical settings to produce high quality images of the inside of the human body. The obtained data from MR image is used for detecting tissue deformities purpose mostly. Before getting through the analysis of some technical advancement in brain studies, brain image segmentation played a very important role. This project provides a completely automatic segmentation of the tissues of interest such as cerebrospinal fluid (CSF), white matter and gray matter from MR imaging of the human brain. Three MRI data types are required: T1-weighted (T1), Proton-Density weighted (PD) and T2-weighted images (T2). Two methods have been used in this project. (1) Bipartite-merger algorithm (slice based). Bipartite-merger is using bit-reduction fuzzy C means algorithm in the system, optimally matches the clusters between any two adjacent slices of a volume using a minimally weighted bipartite matching algorithm. Later use heuristics to label which chain is what i.e. Skull, CSF, GM or WM. (2) Single pass algorithm (volume based). The single pass algorithm partitions the entire image volume by scanning the data from the disk only once. We provided a final computationally inexpensive segmentation refinement step in Fuzzy clustering algorithm to model the clusters as Gaussians and computes the covariance matrix associated with channels. Then the final segmentation is produced computing posterior probabilities assuming priori for all 3 classes are same.

A Hidden Markov Model Approach to Available Bandwidth Estimation and Monitoring

Presenter: Cesar Guerrero
Contributor: Miguel Labrador, Computer Science and Engineering

Available bandwidth estimation techniques are being used in network monitoring and management tools to provide information about the utilization of the network and verify the compliance of service level agreements. However, the use of these techniques in other applications and network environments is limited by the long convergence times, accuracy errors, and the amount of overhead that they introduce. In this poster we show that a Hidden Markov Model combined with a moving average technique can be applied to estimate the available bandwidth of an end-to-end path in a fast, accurate, and non intrusive manner. This novel approach is implemented in a software tool called Traceband. The tool is evaluated in a real network that emulates Internet traffic. Accuracy, convergence time, and intrusiveness are the metrics evaluated. The performance of Traceband is compared with the two most important tools in the literature: Spruce and Pathload. Experimental results demonstrate that Traceband is as accurate as Spruce and Pathload but considerably faster, and introduce less overhead. Traceband's convergence time is demonstrated using bursty cross-traffic, as it is the only tool that accurately reacts to zero-traffic periods, which may be particularly useful for those applications that need to make decisions in real time. Using self-similar traffic, Traceband's mean accuracy and variability degrade with the Hurst parameter but it still performs within reasonable limits.

SW-MER: A Logical Link Control Protocol for Underwater Acoustic Networks

Presenter: Daladier Jabba Molinares, Computer Science and Engineering
Contributor: Javier Espinoza; Miguel Labrador, Computer Science and Engineering

Undersea explorations, tactical surveillance, and environmental data collection are a few of the applications where underwater communication systems are needed. Radio frequency (RF) signals cannot be used underwater because electromagnetic waves do not propagate well and far under water, instead, acoustic communication has been utilized despite its own limitations.

This research introduces a new logical link control protocol for underwater acoustic networks that combines the well-known Stop and Wait and Sliding Window logical link control protocols. The protocol works in a Stop and Wait manner given the half duplex nature of acoustic radios but sending a window worth of m packets in each transmission opportunity in order to improve the channel utilization. The proposed protocol is evaluated and compared with well-known protocols in a simulation tool using two different error channel models. First, the protocols are evaluated using the same simple Bernoulli error model utilized in the analytical performance evaluation of the protocols used for comparisons. Then, the protocols are evaluated using a more realistic channel based on a synthetic trace that corresponds to a shallow water communication channel. This trace is used to derive a two state Markov model that generates the errors in the simulations. Given the bursty and error-prone characteristics of the under water channel, the proposed protocol introduces an exponential packet retransmission strategy. Our simulation results show that the new protocol provides similar throughput performance but better reliability not only in the Bernoulli scenario but also in the scenario recreated by the two state Markov model.

SAHT: a new data structure for P2P directory search

Presenters: Miguel Jimeno, Computer Science and Engineering
Contributors: Ken Christensen, Computer Science and Engineering

Bloom filters are a well known data structure for approximate set membership. Bloom filters are space efficient but require many independent hashes and consecutive memory accesses for an element test. We have developed a hash table data structure that stores string signatures in an array. This new Signature Array Hash Table (SAHT) supports faster element testing than a Bloom filter and requires less memory than a standard hash table that uses linked-list chains. This new data structure seeks to make query handling very efficient to be able to execute it on a small outboard processor to support proxying for P2P directory search. Proxying can reduce the energy use of P2P file sharing.

Cross Layer for Wireless Networks and Application of Game Theory to Wireless Ad-Hoc Networks

Presenters: Murad Khalid, Yongxue Yu, Electrical Engineering
Contributor: Ravi Sankar, Electrical Engineering

Cross layer has emerged as a vital approach for performance optimization, particularly in wireless ad hoc networks. In high density ad hoc network, the throughput performance enhancement due to directional communication diminishes to the omni-directional performance due to increased spatial overlap. Cross layer framework can be effectively used to avoid throughput performance degradation by opportunistic scheduling and adapting to the dynamic changes in the ad hoc network.

Wireless ad hoc networks are wireless networks without fixed infrastructure or centralized administration. The characteristics of ad hoc wireless networks, distributed, selfish and intelligence, make the Game Theory as a promising tools for analysis of contention situation. After introduction to the basic concepts of Game Theory, the applications of it to different aspects of ad hoc networks have been proposed.

Transition of Clinic Diagnostics to Point-of-Care using Nanostructure Assisted MicroBiochip

Presenter: Ke Sun, Electrical Engineering
Contributor: S. Bhansali, Electrical Engineering

Affordable point of care diagnostics is emerging as a major need for the 21st century to ensure affordable healthcare. This is true for both the developing countries (cost) and developed countries (aging populations and hence overwhelmed medical infrastructure). To address this challenge we have been working on the development of microfluidic sensors that can transition blood-based clinic diagnostics to saliva enabled point-of-care detection devices. Saliva test have been proven to be a highly specific diagnostic medium to detect levels of hormones, virus, cancer and drug that can be used in developing countries, neighborhood clinics or at home, where blood sampling and expensive sophisticated methods for detection are not readily available. With the help of modern engineering technologies, measurements and biomarker detections, critical information can be extracted and the signature of chemical marker of the disease can be observed in single drop of saliva. Since the concentrations of interested molecules or proteins are mostly in pmol/L range and complicated compositions in saliva, a highly sensitive, specific and accurate detector is required. In this project, we are targeting on the development of a nanostructure assisted microbiochip as a platform for saliva test applications. Freestanding Au nanowire array grown with a highly controlled method was utilized to test one important stress hormone in saliva, cortisol, as an example. Following this technique, quantitative detection of cortisol concentration in saliva at sub-pmol/L detection limits has been achieved. This technique is three orders of magnitude more sensitive than the current state of the art.

Laser Assisted Real-Time Scaled Telerobotic Manipulator Control with Haptic Feedback for Activities of Daily Living

Presenters: Eduardo Veras; Karan Khokar, Mechanical Engineering
Contributors: R. Alqasemi, R. Dubey, Mechanical Engineering

This poster presents a novel method of using laser data to generate trajectories and virtual constraints in real time that assist the user teleoperating a remote arm to execute tasks in a remote unstructured environment. The laser also helps the user to make high-level decisions such as selecting target objects by pointing the laser at them. The trajectories generated by the laser enable autonomous control of the remote arm and the virtual constraints enable scaled teleoperation and virtual fixtures based teleoperation. The assistance to the user in scaled and virtual fixture based teleoperation modes is either based on position feedback or force feedback to the master. Moreover the user has the option of choosing a velocity control mode in teleoperation in which the speed of the remote arm is proportional to the displacement of the master from its initial position, after the arm was engaged. At any point the user has the option of choosing a suitable control mode after locating targets with the laser. The various control modes have been compared with each other, and time and accuracy based results have been presented for a ‘pick and place’ task carried out by three healthy subjects. The system is intended to assist users with disabilities to carry out their ADLs (Activities of Daily Living) but can also be used for other applications involving teleoperation of a manipulator. The system is PC based with multithreaded programming strategies for Real Time arm control and the controller is implemented on QNX.

Model-Based Recovery of Fluid-Flow Parameters from Video

Presenter: Valentina Korzhova, Computer Science and Engineering
Contributors: Dmitry Goldgof, Computer Science and Engineering;
Grigori Sisoev, School of Mathematics, University of Birmingham, UK

The flow of a liquid film over a rapidly rotating horizontal disk has numerous industrial applications including pharmaceuticals, fine chemical, engineering, bioengineering, etc. Therefore, the analysis and control of complex fluid flows over a rapidly rotating horizontal disk is a major scientific issue. This research develops a novel approach for fluid flow tracking and analysis. Specifically, proposed algorithm is able to detect the moving waves, determine the wave regimes and compute controlling film flow parameters for case of fluid flowing over rotating disk. The input to this algorithm is an easily acquired non-invasive video data. It is shown that under single light illumination it is possible to track specular portion of the reflected light on the moving wave. Hence, the fluid wave motion can be tracked, and fluid flow parameters, including wave velocities, wave inclination angles, and distances between consecutive waves, can be computed. Results compared with the solutions of the mathematical fluid dynamics models. It is shown that the calculated parameters coincide with the predicted ones. The average computed parameters were within 5-10 % of the predicted values.

Next, the developed approach is generalized to model-based recovery of fluid flow controlling parameters: the speed of spinning disk and the fluid-flow rate. The search in space for model parameters is performed as to minimize the error between the predicted flow characteristics predicted by the fluid dynamics model and parameters recovered from video data. Results demonstrate that the speed of a disk and the flow rate are recovered with high accuracy.

Formation of Periodic Crack Patterns in Mo/Si Nanolayers Under Cooling

Presenter: Grygoriy Kravchenko, Mechanical Engineering
Contributors: R. Shields; J. Rachwal; A. Volinsky, Mechanical Engineering

Alternating Mo/Si multilayers, several nanometers thick, are used in X-Ray optics. Annealing at temperatures about 500 °C followed by cooling causes high tensile stresses in the film. At a certain time, the stress is being released by the film cracking forming peculiar fracture patterns in the form of sinusoidal and spiral cracks.

It is known that above 500 °C Mo and Si form the molybdenum disilicide $MoSi_2$, which induces a transformation from compressive to tensile stress in the multilayer structure. The cooling increases the tensile stress due to a thermal expansion mismatch of $MoSi_2$ the Si substrate.

High speed videography with up to 1000 frames per second was utilized to capture the fracture patterns formation. Straight, branched and periodic cracks were observed, depending on the cooling rate. Based on these observations, some mechanisms of the crack patterns formation were revealed.

Audio Visual Patterns in Meeting Room Videos

Presenters: Himanshu Vajaria; Ravi Krishnan, Computer Science and Engineering
Contributors: Sudeep Sarkar; Ranga Kasturi, Computer Science and Engineering

In this poster an approach to speaker diarization and speaker localization is shown. It is an important first step for various tasks such as meeting transcription, automatic camera panning, multimedia retrieval and monologue detection. Given a meeting room video, a method is presented to segment each individual's speech and localize them in the video, based on data from a single audio and video source. The results of this approach enable various kinds of queries such as identifying the participants of a meeting, finding all meetings for a particular participant, locating a particular individual in the video and finding all instances of speech from a particular individual. The proposed approach is better suited to the meeting room domain than the popularly used Mutual Information (MI) approach as evidenced by a hit ratio of 73.8% compared to 52.6% for a MI-based approach. The method allows indexing meeting archives to retrieve all segments from the archive during which a particular individual speaks, in a query by example framework. By performing audio-visual association and clustering, a target cluster is generated per individual that contains multiple multimodal samples for that individual to which a query sample is matched. The use of multiple samples results in a retrieval precision of 92.6% at 90% recall compared to a precision of 71% at the same recall, achieved by a unimodal unisample system.

P300 Based Single Trial Independent Component Analysis in BCI System

Presenter: Kun Li, Electrical Engineering
Contributor: Ravi Sankar, Electrical Engineering

The P300-based Brain Computer Interface (BCI) allows locked-in patients to communicate with a computer. The user focuses on a character in a 6 by 6 matrix, the rows and columns of which are intensified at random. As the row and the column that contain the attended character will elicit a P300 component, the user's choice can be identified by determining which row and column elicited a P300. At present the matrix must be scanned at least 10 times to allow a detection of the P300. One of the issues that require addressing in order to advance the current state-of-the-art in BCI is the operational speed.

A new P300 based single trial Independent Component Analysis (ICA) on EEG signal is presented in this poster. ICA is a Blind Source Separation (BSS) technique that has the ability to reveal the hidden features and detect P300 in a single trial. In our preliminary study, we have achieved 76% accuracy by feeding only one trial to the designed ICA algorithm. This result confirms us that ICA has the ability of significantly improving the processing speed and accuracy of P300 analysis.

SiC Thin Film Growth for Advanced Electronics, MEMS Sensors and Biomedical Devices

Presenter: C. Locke,[1] USF SiC Group
Contributors: C. Frewin[1]; P. Spagnol[2]; M. Reyes[1,3]; S.E. Saddow[1]
[1] Electrical Engineering; [2] SRI International, Largo, FL; [3] Chemical Engineering

Silicon carbide (SiC) is a wide band gap semiconductor material being developed as a platform material for device and sensor fabrication. Unlike silicon-based devices which can only operate at temperatures up to 250 °C and are easily destroyed in harsh chemical and biological environments, SiC-based electronic devices can endure elevated temperatures up to 650 °C and exhibit very broad chemical inertness and biocompatibility. Heteroepitaxial growth of cubic silicon carbide (3C-SiC) on silicon substrates via CVD offers a relatively low cost method of growing large-area SiC thin films. However, due to the 22% lattice spacing mismatch and 8% thermal expansion coefficient difference between 3C-SiC and Si, crystal defects, uneven surface morphology and film stress deformation can complicate device fabrication and operation. The USF SiC group has pioneered the use of chlorinated chemistry to increase the growth rate of 3C-SiC on Si while improving the material quality. Numerous applications have benefitted from the material grown at USF, such as MEMS accelerometers at SRI, Largo, FL, advanced electronic devices at Caracal Semiconductor, Pittsburgh, PA, as well as graphene film synthesis at the Max-Planck-Institute in Stuttgart, DE. Our films have been fully characterized, both in-house as well as at the IMM-CNR, Catania, Sicily (IT) and the mechanical properties measured at USF in Dr. Volinski's group have demonstrated the extreme hardness and mechanical strength of thin films of 3C-SiC on Si.

Lumped Element Tunable Band Pass Filter

Presenter: Vamsi K Mallidi, Electrical Engineering
Contributor: T. Weller, Electrical Engineering

This poster discusses the concept of tunable band pass filters. This filter uses Varactor diodes to achieve the feature of tunability. The main concentration in this poster will be the design of proper reliable model for predicting the behavior of the filter; this includes the approach followed to get a good comparison between measured and simulated results. This discussion includes the factors leading to improper mismatch and some unaccounted issues like issues with internal ports and compact design issues.

Chemical Mechanical Planarization

Presenter: Chhavi Manocha, Chemical and Biomedical Engineering
Contributor: A. Kumar, Mechanical Engineering

With an increase in the multilevel integrated circuit manufacturing, the process of planarization is becoming increasingly important. To facilitate local and global planarity, Chemical Mechanical Planarization has become the method of choice. As the name suggests, both, chemical and mechanical forces work simultaneously to achieve the required degree of planarity with minimal defects. The process involves the interactions of the input variables like wafer, abrasive slurry and the polishing pad. The wafer is polished over a polyurethane pad using abrasive slurry followed by regeneration of the pad using abrasive disks. Basic investigations have been done to understand the effect of these process parameters and quantify the results in terms of in-situ coefficient of friction, material removal rate, surface defects and pad wear.

Framework for Performance Evaluation of Object Detection and Tracking: Data, Metrics, and Protocol

Presenters: Vasant Manohar, Dept. of Computer Science and Engineering
Contributors: P. Soundararajan, V. Korzhova, J. Zhang, D. Goldgof, and R. Kasturi., Dept. of Computer Science and Engineering

Common benchmark datasets, standardized performance metrics, and baseline algorithms have demonstrated considerable impact on research and development in a variety of application domains. These resources provide both consumers and developers of technology with a common framework to objectively compare the performance of different algorithms and algorithmic improvements. In this paper, we present such a framework for evaluating object detection and tracking in video: specifically for text, face, hand, person, and vehicle objects. This framework includes the source video data, ground truth annotations performance metrics, evaluation protocols, and tools including scoring software and baseline algorithms. For each detection and tracking task and supported domain, we developed a 50-clip training set and a 50-clip test set. Each data clip is approximately 2.5 minutes long and has been completely spatially/temporally annotated at the I-frame level. Each task/domain, therefore, has an associated annotated corpus of approximately 450,000 frames. The scope of such annotation is unprecedented and was designed to begin to support the necessary quantities of data for robust machine learning approaches as well as statistically significant comparison of the performance of algorithms. The goal of this work was to systematically address the challenges of object detection and tracking through a common evaluation framework that: permits a meaningful objective comparison of techniques, provides to the research community with sufficient data for the exploration of automatic modeling techniques, encourages the incorporation of objective evaluation into the development process, and contributes useful lasting resources of a scale and magnitude that will prove to be extremely useful to the computer vision research community for years to come.

Accurate 3D Modeling of Breast Deformation for Temporal Mammogram Registration

Presenters: Yan Qiu; Vasant Manohar, Computer Science and Engineering
Contributors: Xuejun Sun; Dmitry Goldgof, Computer Science and Engineering

Clinically it is important to combine information provided by images from multiple views or at different times. Taking regular mammographic screening and comparing corresponding mammogram are necessary for early detection of breast cancer, which is also the key to successful treatment. However, mammograms taken at different time are often obtained under entirely different compression, orientation or body position. A temporal pair of mammogram may vary quite significantly due to the spatial disparities caused by the variety in acquisition environments, including 3D position of the breast, the amount of the pressure applied, etc. Such disparities can be corrected through the process of temporal registration. We propose to use finite element model for temporal registration of digital mammography. In our work, we applied patient specific breast model, where patients have both mammograms and MRIs available. Our experiments showed that our finite element method increased the sensitivity to temporal pathological changes. With lesion correspondence, our finite element method could be used to suppress technical variations (e.g., mammogram positioning or compression) and to emphasize genuine alterations in the breast.

An Economic Sequential Probability Ratio Test (ESPRT) Model for Early Detection of Epidemic Outbreaks

Presenter: Dayna Martínez, Industrial and Management Systems Engineering
Contributors: Das,T.; Zayas-Castro, J., Industrial and Management Systems Engineering

Threats of terrorism through biological agents along with naturally occurring epidemics require an effective early warning system for detection and rapid response. Since the data emanating from the health infrastructure (hospitals, clinics, and pharmacies, in particular) inherently contains the signals of such outbreaks, many early warning systems have been developed exploiting such data. Almost all of these systems use purely statistical approaches such as control charts, regression models, and time series analysis for alert generation. However, since any detection strategy is subject to errors due to false alarm and detection delay, we adopted an economic approach that minimizes the total cost associated with the errors. The cost model considers the epidemiological dynamics (i.e., the spread mechanism), and a detailed estimate of cost to society from false alarms and added infections due to detection delay. Our model uses a statistically efficient change point detection technique knows as sequential probability ratio test (SPRT), the parameters for which are obtained by optimizing the cost model. The model was tested using real data from BioDefend, a syndromic surveillance system developed by the Center for Biological Defense at the University of South Florida.

Low-Cost Omni Antenna Arrays

Presenters: B. Zivanovic; J. McKnight, Electrical Engineering
Contributor: T. Weller, Electrical Engineering

A dual series-fed, four microstrip patch and coplanar waveguide slot a array antenna that utilizes planar design for ease of fabrication and signal routing is presented. The natural tendency of a series fed array to have beam tilting over frequency is circumvented by using opposing, anti-symmetric balanced feed points. This approach makes this element suitable for low cost frequency-hopped phased array antennas. An approach for inter-element matching to evenly distribute power to each element is also described. The four element microstrip patch antenna array operates at 4.85GHz with approximately 600MHz of bandwidth.

A Jerusalem Cross Frequency Selective Surface Flushed with a Superstrate for Operation at the 2.4GHz ISM Band

Presenters: S. Melais, Dept. of Electrical Engineering
Contributors: T. Weller, Dept. of Electrical Engineering

The work presented in this poster consists of the design of a Jerusalem Cross Frequency Selective Surface (JC-FSS) for use as ground plane for a small antenna with operation at the 2.4GHz ISM band. A JC-FSS is a textured periodic surface that alters the electromagnetic properties of a ground metal surface. The main advantage for this design in comparison to other FSSs is the angular stability achievable in relation with the impinging incidence angle for both TE and TM polarized plane waves. The proposed configuration is made of the periodic texture surface (JC-FSS) sandwiched between two dielectrics. The dielectric slab on top is a superstrate mimicking the dielectric of antenna flushed on top of the FSS. The dielectric slab on the bottom represents the dielectric separating the texture surface (FSS) from the back metal. The simulation results show that this configuration operates adequately covering the desired frequency (2.39-2.5GHz) and offering an angular stability at 2.45GHz of 70 degrees.

Exotic Polyaniline Nanostructures for Hydrogen Storage

Presenter: M. U. Niemann, Clean Energy Research Center, Mechanical Engineering;
Sesha. S. Srinivasan, Clean Energy Research Center, Electrical Engineering
Contributors: Yogi Goswami, Clean Energy Research Center, Chemical and Biomedical Engineering; Lee Stefanakos, Clean Energy Research Center, Electrical Engineering;
Ashok Kumar, Mechanical Engineering

With the emerging need of clean and renewable energy sources, it is necessary to find a storage medium for the most abundantly available fuel of the future – hydrogen. For this purpose, polyaniline (PANI) nanostructures such as nanofibers and nanospheres have been synthesized using chemical templating and electrospun techniques in presence of surfactants as dopants exhibiting large surface areas, and thus a large amount of potential hydrogen storage sites. The reversible hydrogen sorption characteristics, namely kinetics, pressure-composition isotherms and life-cycle measurements were performed on these PANI nanostructures at high hydrogen pressures and moderate temperatures (i.e. less than 125°C). Rapid uptake and release of hydrogen (~95% of hydrogen uptake in less than 10 minutes) was observed which is most likely due to the unique nanostructures of PANI fabricated in the present study. The structural, microstructural, chemical and optical characterizations were compared and correlated with the observed hydrogen sorption behavior in these PANI nanostructures. The PANI nanostructures offer a unique advantage over more traditional hydrogen storage mediums, such as metal hydrides, in that they are easy and inexpensive to synthesize and are virtually unreactive with the atmosphere. Additionally, they provide for a high amount of hydrogen storage capacity, easily surpassing the requirements set forth by the Department of Energy, as well as having the advantage of being able to reversibly store the hydrogen within a usable temperature range.

Roof Damage in New Homes Caused by Hurricane Charley

Presenter: Nick Meloy, Civil and Environmental Engineering
Contributors: R. Sen; N. Pai; G. Mullins, Civil and Environmental Engineering

Hurricane Charley was the first Category 4 hurricane to strike Florida after 1992. This study presents results of an investigation on the performance of 425 of 747 roofs of new homes in Punta Gorda Isles, a sub-division of Punta Gorda that was directly in the path of Hurricane Charley shortly after it made landfall. The homes examined were larger, concrete/clay tiled roof homes having irregular floor plans and complex roof configurations not explicitly addressed by prevailing wind load codes. Roof damage was evaluated using images from aerial photographs taken at an elevation of approximately 762 m (2500 ft.) Specialized software was used to quantify damage. Damage was classified based on tile loss area. The study showed that the vast majority of the roofs were either undamaged or sustained minor damage. Fewer than 14% were classified as damaged. The most common observed tile loss was along ridges, corners or in the hip zone where negative uplift pressures are recognized to be the highest. Given the modest observed damage, prevailing methods for estimating wind loads for irregular buildings specified in codes may be adequate. Problems encountered may be best resolved through new details for attaching tiles on ridges, corners and hip zone.

CPW-FED Arrow-Shaped Slot Antenna Design for Ultra Wideband (UWB) Applications

Presenter: Cesar Morales, Electrical Engineering
Contributor: Jing Wang, Electrical Engineering

A novel co-planar waveguide (CPW) arrow-shaped slot antenna is presented for Ultra wideband (UWB) applications. By means of a slightly increased operational bandwidth, improvements in the full coverage of the allocated band for UWB applications have been achieved, providing more robustness for deviations produced during the electrical coupling with the entire system and a higher tolerance margin during the fabrication process. The antenna design consists of a rectangular slot (13 x 22mm^2) on the ground plane of a single metal layered substrate and a convenient arrow-shaped exciting stub which can be easily tuned because of the existence of few construction parameters. FR4 substrate is implemented, with a relative permittivity constant of 4.31 and dielectric loss tangent of 0.021. Three constructed antennas with the same dimensions (34 x 29mm^2) have 8.1±0.1 GHz of matched bandwidth with VSWR ≤ 2, all of them containing the entire spectrum assigned for UWB systems. Particularly, one of the main resonance frequencies is located in one of the ISM (Industrial, Scientific and Medical) radio bands at 5.8GHz. Also, stable radiation pattern was achieved in the entire frequency spectrum assigned for UWB applications. In addition, small size and compact construction make the CPW-FED arrow-shaped antenna a feasible and suitable antenna option for UWB systems.

Evaporation of Pump Oil and Alkanes

Presenter: Nathaniel Waldstein

Abstract not available.

Peace Corps Master's International Program

Civil and Environmental Engineering

Presenter: C. Naughton; J. Meeks; K. Orner, Civil and Environmental Engineering
Contributor: J. Mihelcic, Civil and Environmental Engineering

The MI program combines one year of graduate studies at USF and 27 month service in the Peace Corps as water/sanitation volunteers where students conduct research related to water, health, and sustainability. Examples of recent research topics have included: 1) development of a life cycle thinking approach to evaluate the sustainability of water-sanitation projects in the developing world and 2) examination of specific pathogen destruction mechanisms in compost latrines that are being used in Panama.

A logical framework was developed for identifying and analyzing the factors that affect sustainable development of water and sanitation projects. A life cycle thinking approach was used to assess how project sustainability can be improved throughout the project lift. Five life stages are identified to represent the life of a development project. Also, five sustainability factors that are common in development literature and the policies of international aid organizations are described. Using these factors and stages, an assessment matrix was developed that can be used in project planning or as an evaluation system to identify strengths and weaknesses.

For the research performed on pathogen destruction in composting latrines, field measurements were performed on approximately 100 compost latrines located in six rural communities in Panama. The fundamental processes which cause pathogen destruction in a compost latrine were determined. Further, human behavior associated with how the latrine owner impacts pathogen destruction was analyzed. Temperature, pH, moisture level, C/N ratio, and the presence of select pathogens in latrines were measured in the field. A desiccant analysis was also performed.

Arsenic Adsorption Characterization: Co-contaminants and Competing Ions Effects

Presenter: Douglas Oti, Civil and Environmental Engineering
Contributors: Maya Trotz; Erlande Omisca; Ken Thomas;
Joniqua Howard, Civil and Environmental Engineering

Arsenic contamination in both surface and ground water is a major issue affecting many communities around the world, especially those ill equipped to remediate to an acceptable level for drinking water consumption. Arsenic remediation from water using adsorption process is an emerging technology that is relatively cheap, low maintenance, and produces minimum residual footprint. This study evaluated the efficiency of arsenic remediation with Kemiron, a commercially available iron oxide adsorbent, by examining the adsorption characteristics of arsenic in a presence of selenite and nickel as co-contaminants in the solution and calcium, ammonium, sulfate and carbonate ions as adsorption competitors.

Batch adsorption equilibration and kinetic tests were conducted in ultra pure water with background ionic strength of 0.1 N and 0.001 N of $NaNO_3$ under controlled conditions of temperature, and Kemiron solids concentration. The adsorption tests were also done on arsenic solutions with various background ions simulating surface water, ground water and landfill leachate. The impact of the adsorbent grain sizes were also evaluated using 38 µm, and 500-600 µm Kemiron grain sizes.

The findings showed that Kemiron is an effective adsorbent for remediating arsenic in surface water, in ground water and in land fill leachate. The study also showed that background ionic strengths of 0.1 N and 0.001 N of $NaNO_3$, the presence of nickel, SO_4^{2-} and CO_3^{2-} ions with concentrations as high as 1000 mg/L had no impact on the mass of arsenic adsorbed. However the presence of selenite, and calcium ions of relatively lower concentrations significantly affect the mass of arsenic adsorbed.

Alternative Method for Measuring Dynamic Changes in Surface Energy

Presenter: Pradeep Mishra, Mechanical Engineering
Contributor: Nathan B. Crane; Alex Volinsky,
Mechanical Engineering;

Micro-fluidic devices are very sensitive to surface interactions. This sensitivity has enabled many unique methods of manipulating fluids at the microscale. One method that has received particular attention is electrowetting-the change in apparent surface energy in an applied electric field. While demonstrations are promising, these effects can be sensitive to many time-dependent factors. However, measurement techniques based on contact angles are sensitive to fluid inertial effects and contact angle hysteresis so that they are not amenable to characterize time varying surface properties. To address this limitation, we have created a modified indenter for a Hystiron TriboIndenter. The indenter is a flat glass plate. When a small drop is confined between the plate and a substrate, the drop contact area is unchanged by changes in the substrate surface energy. There-plane force on the plate is then related to the difference in surface energy across the plate. Since the fluid motion is minimized, the time response of the measurement is only limited by the response of the force sensor. The sensitivity of this method to alignment errors is summarized based on modeling results. Preliminary data is used to show how the method can be used to measure the time response of electrowetting.

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The use of Nano Magnets for the Creation of Logical Devices

Presenter: Javier Pulecio, Electrical Engineering
Contributor: Sanjukta Bhanja, Electrical Engineering

The purpose of this research is to fabricate nano-scale magnets with the intention of creating logic devices. Here we present preliminary work of scaled nano magnets in Magnetic QCA smaller than previously reported, and some fabricated designs of more complex logic circuits.

Determining Curvature of X-Ray Silicon Mirrors, using X-Ray Diffraction

Presenter: James Rachwal, Mechanical Engineering

Silicon wafers are used a substrates for X-Ray optics, however the silicon wafers need to be curved, so as to focus the X-Ray beam to a narrow point. The X-Ray mirrors need to be curved in the x, and y directions. This complex curvature can be difficult to measure, however it may be possible to measure this type of curvature using X-Ray diffraction. A four-point bending fixture was designed for in-situ X-Ray bending experiments. With the sample in the bending fixture, the lattice parameter is determined using the Bragg's law. In order to reduce errors caused by a vertical sample shift, a copper powder was added to the wafer as a reference. The results of this experiment showed the possibility of measuring curvature of X-Ray mirrors using this technique.

Patterned Electrodes For Thickness Shear Mode Quartz Resonators To Achieve Uniform Mass Sensitivity Distribution

Presenter: Anthony Richardson, Chemical and Biomedical Engineering
Contributor: Venkat R. Bhethanabotla, Chemical and Biomedical Engineering

Development of an electrode-modified thickness shear mode (TSM) quartz resonator that is responsive to nanogram mass loadings, while exhibiting a mass sensitivity profile that is independent of material placement on the sensor platform, is presented in this poster. The resulting nanogram balance would greatly enhance the field of mass measurement and become useful in applications like droplet gravimetry, the study of non-volatile residue (NVR) contamination in solvents. A ring electrode design predicted by an analytical theory for sensitivity distribution to achieve the desired uniform mass sensitivity distribution is presented. Using a microvalve capable of depositing nanogram droplets of a polymer solution, and a linear stepping stage for radial positioning of these droplets across the sensor platform, measurements of the mass sensitivity distributions were conducted and presented. The measurements agree well with theory. Further improvements are possible and are identified to achieve better uniformity and to reduce the instability of resonant frequency of these devices.

Enhancements to Surface Acoustic Wave Biosensor Designs

Presenter: Mandek Richardson, Chemical and Biomedical Engineering
Contributors: Venkat R. Bhethanabotla, Chemical and Biomedical Engineering;
Stefan Cular, Defense Threat Reduction Agency;
Subramanian K.R.S. Sankaranarayanan, Harvard University

We studied the enhancing effects of microcavities in the delay path of 36° YX-$LiTaO_3$ surface acoustic wave (SAW) devices using finite element analysis. The microcavities combine several principles of wave propagation enhancement producing a theoretical device with 19.25 dB lower transmission loss and 4.83 times greater sensitivity than traditionally enhanced SAW sensors. Simulation studies included in this presented work include: non-filled and polystyrene filled microcavity devices, standard delay line shear-horizontal SAW, optimized Love-wave and etched grating sensors. In addition, future work will be presented previewing the use of Deep Reactive Ion Etching (DRIE) to fabricate microcavities onto SAW device to experimentally test the results from the finite element study. Once experimental devices are realized the device will be utilized as a sensor to detect ovarian cancer biomarkers.

Exploration of Compiler Optimization Techniques for Leakage Reduction through Power Gating

Presenter: Suumyaroop Roy

Power gating is a circuit level technique employed to reduce standby leakage in a circuit block by cutting off the supply voltage to it. A processor architecture, that supports power gating of its resources and provides power gating instructions that activate and deactivate them, needs adequate compiler support so that power gating instructions can be inserted into the code to reduce leakage in resources that remain idle for long periods of time. However, the resource usage characteristics depend on the instruction composition of the code that is generated by the compiler. In this work, we explore target independent compiler optimizations, that modify the functional unit usage profile in program loops, to enhance the opportunities for power gating of functional units in an embedded processor architecture. The optimizations performed on the code are sparse conditional constant propagation, lazy code motion, weak strength reduction, and operator strength reduction. Insertion of power gating instructions is performed by inspecting the functional unit usage of the regions in the program enclosed within loops. We model the processor architecture with power gating support around an ARM core and use the MachineSUIF framework for implementing all the compiler tasks. Finally, we use the Simplescalar-ARM distribution to perform power and performance evaluation with a set of benchmarks from MiBench and MediaBench suites. Experimental results indicate that the integer multiplier in the processor core can be power gated for up to 99% of its idle cycles, for integer benchmarks, and up to 93%, for floating-point benchmarks, when all the optimizations are performed.

Phase Noise Predictions for Active RF Devices

Presenter: B. Seward, Electrical Engineering
Contributors: L. Nettles, TriQuint Semiconductors; C. Baylis, Baylor University, Electrical Engineering; W. Graves, Trak Microwave; L.Dunleavy, Electrical Engineering

This poster depicts the study of phase noise in simulated and tested designs for low-noise amplifiers and active frequency triplers. With high levels of phase noise present in a system, there is higher probability for errors in digital transmission systems. The goals for this research is to investigate the prediction of the degradation in system phase noise caused by transistor-based amplifiers and multipliers. Specifically of interest is to verify whether or not modeling of 1/f noise in transistor models represented in design simulation models can lead to predictable phase noise contributions of amplifiers and multipliers. The amplifiers and multipliers under investigation are to be tested for phase noise performance and compared to corresponding circuit simulations. As of yet the presenter and contributors are not aware of such work being presented elsewhere.

Design of an Efficient Quartz Crystal Nanobalance with a Uniform Sensitivity Distribution

Presenter: Reetu Singh, Chemical and Biomedical Engineering
Contributor: Dr. Venkat R. Bhethanabotla, Chemical and Biomedical Engineering

A quartz crystal microbalance (QCM), based on a transverse shear mode piezoelectric crystal operating at high frequencies, is gaining immense popularity in chemical and bio-sensing applications due to higher mass sensitivities as compared to the traditional analyzers and lesser sensitivity to vibrations. However, these devices suffer from non-uniformity of sensitivity distribution along the sensor surface thereby limiting their use for the determination of mass. The sensitivity profile can be influenced by a number of factors like the electrode design and surface properties of the crystal. In this poster, a finite element (FE) model of the QCM is presented to investigate the mass sensitivity and its radial distribution on the sensor surface for various electrode designs. Such a model will aid in the development of versatile nano-balances with a uniform sensitivity distribution. The QCM device (operating frequency 9 MHz) was based on an AT-cut quartz crystal, cut at 35.35 degrees to the z-axis, with gold electrodes on the top and bottom surfaces. The device was 8.0 mm diameter and 0.185 mm thick with 5.0 mm diameter gold electrodes having a thickness of $0.15*10^{-3}$ mm on either side of the QCM. Our results indicate that the device displacement and the sensitivity peaks in the center and the distribution is slightly elliptical. The sensitivity distributions for different electrode designs will be presented and compared. The aim is to achieve a uniform sensitivity distribution so as to develop a versatile nano-balance.

Orthogonal SAW Device Based on Langasite for Enhanced Biosensing

Presenter: Reetu Singh, Chemical and Biomedical Engineering
Contributors: Venkat R. Bhethanabotla, Chemical and Biomedical Engineering

SAW sensors find intensive applications in chemical and biological sensing. Typically, biosensing applications require the detection and measurement of biomarkers in fluid media and require the integration of SAW devices with microfluidics. However, most of the biosensors are plagued with the issue of non-specific protein binding and analyte discrimination. Thus, simultaneous sensing and non-specifically bound (NSB) protein removal is a challenge in biosensing applications. Acoustic streaming, defined as fluid motion induced from high intensity sound waves, can be used to remove these non-specifically bound proteins and allow sensor reuse. In this poster, a novel biosensor based on a Langasite substrate is investigated for use in biosensing applications, using finite element model. A SAW device based on Langasite, with dimensions 120μm width x 800μm propagation length x 300μm depth, was simulated using coupled-field elements to study wave propagation in such a device. Two IDT finger pairs were defined on the surface for each port and were modeled as mass-less conductors represented by a set of nodes coupled by voltage degrees of freedom. The propagation characteristics of waves, obtained using an AC analysis, in the different Euler directions will be presented. Based on the nature of waves identified in this study, our results indicate that the (0, 22, 90) Euler direction in Langasite can be utilized for biosensing and the (0, 22, 0) direction can be utilized for acoustic streaming to remove NSB proteins. Thus, the novel biosensor based on a Langasite substrate can be used for simultaneous sensing and NSB removal.

Benchmarking Comparison of Thermal and Diode Sensors for Pulsed Power Measurement

Presenter: SM. Sivalingam, Electrical Engineering
Contributors: C.Baylis; L.Dunleavy, Electrical Engineering.

In this poster a Pulsed Power system is presented. The system explores conditions under which accurate pulsed power measurements can be made with both a thermal sensor and a diode sensor. For the thermal sensor, pulsed power is estimated from a simple calculation based on the average power of the pulsed RF signal. For the diode sensor, gating is used to enable direct measurement of the pulsed power. As expected, the results of measurements taken with varying pulse lengths and a constant period show that the dynamic range of the thermal sensor is approximately proportional to the pulse length. The results also indicate that, while a thermal sensor can provide accurate results for many situations, the diode sensor can be used to measure with higher precision than the thermal sensor for lower duty cycles. The poster demonstrates a benchmarking procedure that can be used to explore limitations and capabilities of power sensors as well as elements such as the input RF switch used for pulsed power measurements.

Challenges in THz Rectifying Antenna Design and Implementation

Presenter: Kosol Son, Electrical Engineering
Contributors: I-Tsang Wu; Jing Wang, Electrical Engineering

Energy requirement will drive us to be more creative in diversifying the energy market with a good sustainable energy source. Therefore we should look toward alternate means of harvesting energy other than current existing systems. The requirement for an alternate means would have to meet the needs of a cheaper and more reliable source of energy. The rectifying antenna (rectenna) is a device that is similar to photovoltaic systems but instead uses electromagnetic waves as an energy source, then it converts the electromagnetic waves into usable energy. We are aiming in the TeraHertz range because there is an abundant source of energy in the Infrared region of the electromagnetic spectrum. There has been research done on this topic since the 1960's and the concept has been proven to work in the lower microwave frequency and was able to obtain an efficiency greater than 85%. In our research, we will be addressing and solving some of the challenges involved with rectennas. Currently, there are no working rectenna systems in the market. This is due to the challenges involved with the design, system integrations, and the fabrication processes of producing a working rectenna in the TeraHertz range.

What are the Limits of Human Surveillance Performance?

Presenter: Noah Sulman, Psychology
Contributors: Thomas Sanocki, Psychology;
Dmitry Goldgof; Ranchagar Kasturi, Engineering

We present a method for evaluating human surveillance performance that mimics the demands of real world surveillance. Observers were presented with 4 or 9 displays containing moving objects. Observers signaled when target events, which could appear singly or in groups of 2 or 3, were detected in any of the displays. Observers missed many targets (60%) when required to monitor 9 displays. Fewer targets (20%) were missed when only 4 displays were monitored. Additionally, performance was impaired when targets occurred in close temporal succession. Understanding the limits of human surveillance performance will facilitate the development of computer vision technologies that may enhance the human-machine interface.

Design of Concurrently Testable Molecular QCA Circuits

Presenter: Himanshu Thapliyal
Ph.D. Student, Department of Computer Science and Engineering
Advisor: Dr. Nagarajan Ranganathan

Quantum dot cellular automata (QCA) is one of the emerging nanotechnologies that have an extremely small feature size, higher clock frequency and ultra low power consumption. QCA provides an alternative way of computation, in which the logic states ('0' and '1') are defined by the position of electrons. Nanotechnologies, including molecular QCA, are susceptible to high error rates. In this poster, we present novel strategies to design concurrently testable molecular QCA circuits. Synthesis results on standard benchmark combinational functions are presented. The QCA design of 2 pair 2 rail checker is also presented. QCA layouts and the verification of the designs performed using the QCADesigner and HDLQ tools are shown.

Thermal Management of Electronic Devices Using Self Assembled Thermoelectric Coolers

Presenter: James Tuckerman, Dept. of Mechanical Engineering
Contributors: Pradeep Mishra, Nathan B. Crane
Dept. of Mechanical Engineering

Electronic device thermal management improvements are critical to continued increases in computing performance. Thermoelectric coolers (TECs) show promise in meeting this need. Still, recent Intel work suggested the current system performance is insufficient for cooling chip hot spots. Improving TEC performance requires both improved material properties and improved manufacturing techniques. The most promising avenue to improved properties is the incorporation of nanostructured materials. However, optimum performance in many applications requires elements in the 50-500 m thickness ranges—too thick to be manufactured by film processing, but difficult to assembly by “pick and place” or traditional vibration methods. This tradeoff is illustrated through 1D thermal analysis of an electronics cooling application. Self assembly is a promising approach to improve the manufacturing limitations to component integration at these size scales. Functional one couple thermoelectric coolers with Bismuth Telluride elements 2 x 4 x 4 mm^3 have been fabricated using Self assembly process, and Monte Carlo simulation is used to study the scaling of the self-assembly approach to assemblies with more components. While assembly rates and system yield can be a challenge, several approaches are presented for increasing both rates and yield.

The Nanotech Facility

Presenter: Rob Tufts

The Nanomaterials and Nanomanufacturing Research Center (NNRC), housed in the Nanotech I building, is a university-wide user fabrication and metrology center providing state-of-the-art equipment, professional support personnel and infrastructure to enable multidisciplinary research. The Nanotech I facility supports research projects of faculty, graduate students, undergraduates and industrial researchers. Research areas include: nanomaterials and nanomanufacturing methods related to fundamental materials science, sensors, actuators, electronics, bio-systems, medical products, optics and integrated micro/nano-scale systems. The Nanotech I (NTA) building is located on the University of South Florida Tampa Campus between the Science Center building (SCA) and the Kopp Engineering Building (ENG).

Installed and maintained within the Nanotech I facility are many major investment analytical instruments and process tools which can be used by researchers following training and certification. NNRC staff members offer over 35 different training sessions or short courses on the various research instruments and fabrication processes that are offered or available in the Nanotech I facility. For a complete list of the tools and trainings, please see our web page, http://nnrc.eng.usf.edu.

RF MEMS Resonator by IC-Compatible Low Temperature Process

Presenter: Mian Wei, Electrical Engineering
Contributor: Jing Wang, Electrical Engineering

Up to now, several approaches to monolithic integration of MEMS and transistors have been demonstrated. Vibrating micromechanical disk resonators which utilize the electroplated Nickel as the structural material along with a solid high-k dielectric capacitive-transducer gap deposited by Atomic Layer Deposition technology have great potential to offer unprecedented performance, (i.e., high-*Q*, high frequency). Despite the drift problems encountered in early attempts to use nickel as a structural material in MEMS devices, this low temperature fabrication technology has advantage for post-transistor planar integration. The nickel microstructure is formed through the electroplating and photoresist modeling process which enables the microstructure to have extremely high aspect ratio while retaining the overall process temperature under 50ºC. A process temperature this low should allow the RF MEMS devices to be fabricated directly on top of foundry IC chips, thus enabling post-transistor integration with minimum parasitics. In addition, the electroplating setup for Nickel deposition can be much cheaper compared to the other deposition facilities (e.g., PVD, CVD, etc). In order to lower the motional resistance, a solid dielectric gap is employed instead of an air gap which provides other benefits compared to the air gap such as ease of the process, better stability, eliminating the particles. Using atomic layer deposition (ALD) tool, a ultra-thin and very conformal high-k dielectric layer with atomically controlled thickness down to nm/sub-nm range can be deposited under 100 ºC on the vertical wall of the device structure, which will enhance the efficiency of the capacitive transducer enormously, thus reducing the characteristic resistance of the device.

Topology Maintenance: Extending the Lifetime of Wireless Sensor Networks

Presenter: Pedro Wightman

Topology Control is a very well-known technique to save energy and extend the lifetime of wireless sensor networks. It is usually referred as the process that, given a set of nodes, creates a reduced topology that guarantees connectivity and coverage. We extend this definition by considering Topology Control as two processes: Topology Construction (TC) and Topology Maintenance (TM.) TC is the process of only reducing the initial topology. TM is the process that, during execution, repairs the reduced topology when the current one is no longer optimal. In this work we introduce different strategies and triggering criteria that can be used to switch the network topology. We also implement static and dynamic global topology maintenance strategies using three well-known topology construction algorithms and time- and energy-based triggering criteria, and compare their performance via simulations on sparse and dense networks. Our results demonstrate that the use of an appropriate TM technique extends the network lifetime versus the option of not doing TM at all. In sparse networks, while dynamic global techniques always improve the network lifetime, static techniques may degrade the performance if some conditions are not fulfilled. However, all results are fairly similar compared to the lack of a TM technique. On the other hand, topology maintenance is very well justified in dense networks where important performance improvements can be achieved. In this case, the superiority of dynamic global techniques is evident, and even more as the density of the network increases.

High Efficiency Piezoelectric Resonators by Atomic Layer Deposition Process

Presenter: I-Tsang Wu, Electrical Engineering
Contributors: Dr. Jing Wang; Mian Wei; Mingke Xiong, Electrical Engineering

Piezoelectrically transduced micro-resonator vibrates under ac excitation. When it is exposed to an environment, molecules adsorb or desorb from the surface of the resonator, thus inducing a shift in its resonance frequency. By monitoring the frequency change, the mass of the molecule and amount can be identified in real time. Currently, detection limits of 10^{-12} g (in air) and 10^{-18} g (under vacuum) have been demonstrated using nano-cantilever. Nonetheless, whichever type of resonator is being used, the detection sensitivity is strongly related to frequency and bandwidth of its frequency characteristic; the narrower the bandwidth, the higher the Q, the higher the sensitivity. In order to construct resonators with high-Q characteristic, the material quality of the piezoelectric structural material is critical. Atomic layer deposition (ALD) enables pinhole free coating with exceptional qualities such as uniformity, conformality, low stress, low surface roughness, etc. With its low defect density, the intrinsic loss in piezoelectric material can be greatly reduced. ZnO thin film has been deposited using the ALD system and characterized using XRD and AFM. The film is highly c-axis oriented, and the FWHM is 0.1574° along with low surface roughness. All in all, the data have shown films deposited by ALD offers significantly better properties than those of similar films deposited by PLD and sputtering method. By using ALD film as the seeding layer to control the crystal orientation and quality, we can enhance the performance of piezoelectrically transduced resonator, which can eventually surmount the 10^{-18} g detection limit under atmospheric condition.

Capacitively-Transduced Vibrating RF Micromechanical Resonator

Presenter: Mingke Xiong, Electrical Engineering
Contributor: Jing Wang, Electrical Engineering

For the purpose of miniaturization and on-chip integration of the filter and oscillator function into wireless communication circuits, capacitively-transduced, surface-micromachined vibrating micromechanical resonators have been recently demonstrated with exceptional high quality factor (*Q*>160,000) at VHF frequency range. Despite of the coveted high *Q*, there have been concerns about the power handling and impedance matching capabilities of capacitively-transduced vibrating micromechanical resonators due to their orders of magnitude smaller dimensions comparing to their bulky counterparts, such as quartz crystals. Both device-level and system-level approaches are going to be investigated to reduce the device characteristic impedance while improving its power handling capability. First, at the device-level, the efficiency of the capacitive transducer can be greatly enhanced by replacing the air gap by high-k dielectric material with reduced thickness. Particular, atomic layer deposition (ALD) technique is employed to deposit highly conformal dielectric gap-spacing layer with atomically controlled thickness down to nm/sub-nm scale. As a result, the characteristic impedance of a single device can be reduced by several orders of magnitude. Secondly, as a system-level approach, a large array of identical resonators can be mechanically coupled together to act as a composite device. As a result of the parallel configuration, both the characteristic impedance and the power handing capability can be greatly improved by the number of the constituent devices utilized. The ultimate goal of this work is to develop an on-chip resonator technology, that offers exceptional high *Q*, 50Ω-matched impedance, and good power handling ability while spanning the frequencies from UHF to S-band range.

Optimal Data Distribution and Routing Algorithms

Presenters: Yangyang Xu; Ismail Butun, Electrical Engineering
Contributor: Ravi Sankar, Electrical Engineering

This study includes research and documentation of optimal data distribution and routing algorithms. Simulation and evaluation of the performance of the global routing algorithm for a given initial network topology is achieved. We tried to find the maximum flow in the scenario that every node has to broadcast its information to all other nodes. Information exchanges are global, i.e., among all nodes in the network. We have developed a distributed routing algorithm for the given network. We simulated this algorithm and compared the performances among others.

In the distributed network, the information exchanges are only among the neighboring nodes that are one hop away. Therefore we have extended our research on optimal routing algorithms to MANETs (Mobile Ad-Hoc Networks). We have simulated and evaluated the performance of the routing protocols for the given wireless ad-hoc network topology. We have established the maximum flow for both global and distributed scenarios similar to wired data network."

Improve Formal Verification Through Automated Compositional Reasoning

Presenter: Haiqiong Yao, Computer Science and Engineering
Contributor: Dr. Hao Zheng, Computer Science and Engineering

Formal verification has emerged as a promising complement to the mainstream simulation approaches for functional verification. It can provide almost exhaustive verification coverage. However, its main problem is the state space explosion problem resulting in poor scalability. Compositional verification is an effective approach to verifying large designs. When verifying the constituent modules in a design, over-approximated environment is needed. Traditionally, environment generation that constructs a model of the specific context interacting with the considered module, involves great manual efforts responsible for its limited application in practice. Moreover, approximate environment provided by users are often error-prone and insufficient model the concrete environment. When an environment is too coarse, the extra behaviors increase the chance of producing false counterexamples, which may incur a high computation penalty to distinguish them from the real ones. To address these problems, we present a fully automated method to extract and refine interface constraints for each module in a design to strengthen the initial over-approximated environment for compositional verification of asynchronous designs. This method is fully automated and sound as long as the initial environment for each module in a system is over-approximated. This allows very coarse environments to be used when verification starts. In addition, several state space reduction techniques are introduced, and they may help remove irrelevant behavior, thus making interface refinement more effective. We have implemented our method in the tool FLARE, and the preliminary results demonstrate the effectiveness of our method when verifying several large asynchronous designs.

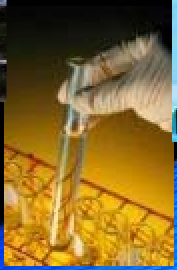
Edge Based Verification of Text Objects in Video Documents

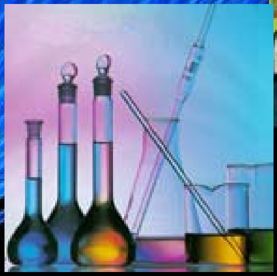
Presenter: Jing Zhang, Computer Science and Engineering
Contributors: D. Goldgof; R. Kasturi, Computer Science and Engineering

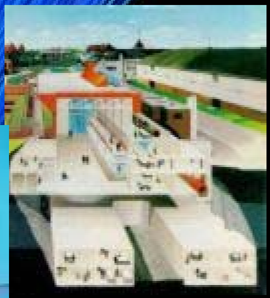
Text extraction in video documents is an important research field of content-based information indexing and retrieval. In this poster, a new edge-based text verification approach for videos is proposed. Based on the investigation of the relation between candidate blocks and their neighbor areas, the proposed approach detects background edges in candidate blocks and erases them by an edge tracking technique. The candidate blocks containing too few remaining edges are eliminated as false alarms. Three text detection evaluation measures, Multiple Object Detection Precision (MODP), Multiple Object Detection Accuracy (MODA), and Sequence Frame Detection Accuracy (SFDA), were used to assess the performance of the proposed text verification approach. Experimental results on 50 broadcast news video clips demonstrated the validity of our approach, 5.7% improvement of MODP, 19.7% improvement of MODA, and 10% improvement of SFDA.

Designed and Compiled by

Rebecca Campbell







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