ENGINEERING AND COMPUTER SCIENCE PAPER ABSTRACTS

A SIMPLE RELIABILITY MODEL FOR A HUMAN MISSION TO MARS USING MONTE CARLO ANALYSIS. *GAYLE HAGEWOOD* AND J. WAYNE MCCAIN, ATHENS STATE UNIVERSITY.

The planet Mars has been the inspiration for mankind's dream of interplanetary human spaceflight for centuries. While inhospitable to human occupation on initial examination, the red planet holds the highest promise of harboring past, present, and future life of any major body in our Solar System. Placing humans on Mars may finally answer the questions of 'are we alone' in the Universe and whether mankind is capable of surviving beyond Earth. After decades of automated orbiters and landers, we are poised to finally make a concerted effort for humans to visit the surface of Mars and return safely to Earth during the next decade. While controversy surrounds the issue of whether to use existing and near-term hardware or develop advanced propulsion and other technologies, one common concern is assessing the probability of crew survival and mission success. The research described here seeks to develop a simplistic model employing a risk network and Monte Carlo simulation that might provide a top-level ‚Äúsanity check‚Äù of commonly proposed mission profiles to be used in management decision making and mission design/refinement. The model was designed to aid in ranking various mission scenarios and improving the probability of success by understanding reliability drivers. While numerical results are presented, this paper emphasizes the methodology.

A BRIEF RISK ASSESSMENT OF AMELIA EARHART'S ATTEMPTED FLIGHT AROUND THE WORLD. *KEVIN P. KEENAN* AND J. WAYNE MCCAIN, ATHENS STATE UNIVERSITY.

This paper presents an analysis of Amelia Earhart’s 1937 attempted flight around the world, examining critical factors that contributed to a concatenation of risks resulting in the mysterious loss of Earhart and her navigator, Fred Noonan. Beginning with a brief history of Earhart’s life and how it shaped her entry into aviation, it describes her aircraft, the equipment on the aircraft for support, and possible causes and effects of her becoming lost. Three plausible reasons for the tragedy are presented, with pertinent facts in the context of modern-day Risk Management. Finally, the most likely explanation for her loss during the last leg of this historic flight is discussed along with supporting rationale. A brief outline for a Risk Management Plan (RMP) is also put forth, which if implemented, could have saved their lives and rewritten history.

VEHICLE DETECTION USING CONVOLUTIONAL NEURAL NETWORKS FOR SEMANTIC SEGMENTATION AND MULTITASK LEARNING ON A LIMITED DATASET OF MULTISPECTRAL SATELLITE IMAGES. *DAVID ODAIBO*, UNIVERSITY OF ALABAMA AT BIRMINGHAM. ZHENG ZHANG AND MURAT TANIK, UAB.

With the exponential increase of satellite imagery, it is becoming increasingly necessary to develop methods to automate the analysis of these images. In this paper, we describe a convolutional neural network architecture that can identify 2 classes of vehicles (large vehicles, and small vehicles) in multispectral satellite images. In satellite images, vehicles are particularly difficult to identify because of the relatively small surface area they cover (just a few pixels) in the overall image. Methods like deep learning require large amounts of data to work well, so this limitation presents a challenge. We show that multitask learning and using a shared representation in a convolutional neural network, results in improved performance in these semantic segmentation tasks when there are limited labeled training samples.

NUMERICAL MODELING OF HUMAN THIGH FOR IMPROVED TOURNIQUET DESIGN. *LUKE SMITH*, UNIVERSITY OF SOUTH ALABAMA.

In severe battlefield injury, tourniquets are commonly employed to restrict blood flow to limbs incurring severe bleeding. During prolonged application, ischemic and reperfusive tissue damage can occur as cells are starved of oxygen and then overwhelmed as blood flow is restored. An understanding of heat transfer may allow future tourniquet design to mitigate this damage. Tissue loss may be reduced by decreasing the temperature of the affected tissue, thereby extending the time available for tourniquet use. This allows for longer transportation of the wounded as well as a greater chance of tissue recovery. Models of heat transfer can be used to understand and design for the human thermoregulatory system. The Pennes bio-heat transfer equation uses a numerical analysis to understand thermoregulation between bone, muscle, fat, and skin within the human body, treating tissue as concentric geometric layers. Using TAITherm thermal software, we constructed a visual numerical model of these layers based on these equations and observed thermoregulatory change due to transient blood flows. A human thermal model was created as a 3-dimensional mesh consisting of 16 thermal layers with the potential for additional clothing layers. The model followed proportions of a 50th percentile male and blood flow was restricted to the left thigh to mimic the effects of tourniquet application. When subjected to steady-state environments of varying temperature, core tissue temperatures were noticeably reduced from lack of blood flow, compared to the actively regulated control model in the right thigh. This difference increased with environmental temperature, with a difference of several degrees between right and left thigh tissue. By adding additional clothing layers and varying body sizes, this difference in temperature may be further observed and controlled.

OPTIMIZING SYSTEM DESIGN USING SYSTEMC AND VHDL. *TRISTEN HIGGINBOTHAM*, UNIVERSITY OF SOUTH ALABAMA.

SystemC is a system design and implementation language that is modeled after C++. This language builds on the user's familiarity of C++, allowing digital design to take place at a relatively higher level with hardware functionality being expressed by behavioral constructs. This language uses libraries very close to or exactly like ones used when writing in C++. Alternatively, VHDL (VHSIC Hardware Description Language) is a commonly used hardware description language which allows the user to design circuitry more explicitly. VHDL allows a system's behavior or its structure to be described, but it not based on a common object-oriented language like C++. While these languages can be utilized to produce functionally equivalent systems, the complexity of the resulting logic determines the optimal design. We identified and analyzed performance differences between SystemC and VHDL implementations through complexity comparisons and analysis of relative chip consumption. Through this research, we are able to determine in what capacity each language is most optimal, be it length of code or simplicity of their respective products.

MICRO-PRISM BASED MULTI-/HYPER-SPECTRAL IMAGING SYSTEM. *DALLAS GUFFEY* AND DR. RAVI GOLLAPALLI, UNIVERSITY OF SOUTH ALABAMA.

In this study a micro-prism array (MPA) is studied as a possible component for spectral separation for usage in the build of a multi/hyperspectral imaging system. The benefits of this component over other components and techniques are that the MPA results in a power-free and a small-form-factor component making it more feasible to be mounted in commercially available digital cameras. Commercial software packages, Trace Pro and Autodesk software were used to design the MPA and Light Tools software for simulation of the object scene.

FIELD EMISSION CHARACTERISTICS OF SELECTIVE AND NON-SELECTIVE CARBON NANOTUBES (CNTS) GROWN ON CERAMIC SUBSTRATE FOR HIGH TEMPERATURE APPLICATIONS. *BAHA YAKUPOGLU*, AUBURN UNIVERSITY. HULYA KIRKICI, UNIVERSITY OF SOUTH ALABAMA.

Carbon Nanotubes (CNTs) are very diverse nano scale materials of the fullerene structural family and they show excellent electrical, chemical and mechanical properties. In this work, selectively and non ‚Äì selectively growing randomly oriented multi-walled Carbon Nanotubes (MWCNTs) are fabricated on ceramic substrates and experimental results are discussed. CNTs are synthesized to be used in high temperature applications on the polished side of %99.4 pure ceramic (aluminum oxide) substrate by using thermal Chemical Vapor Deposition (CVD) technique. Thin films of approximately 5 nm thick Iron (Fe) and Tungsten (W) catalyst layers are deposited on the samples using a DC plasma sputtering system. Different pattern sizes are formed for each sample using conventional microfabrication techniques and Scanning Electron Microscope (SEM) images of selective and non-selective CNTs are presented. Field emission characteristics, turn ‚Äì on fields, and Fowler ‚Äì Nordheim curves are compared in vacuum at varying temperatures. The different pattern size effects on turn on field and effective emission area of CNTs are investigated and presented.

GRAPHENE BASED SPECTRAL AMPLIFICATION FOR INCREASED SENSITIVITY IN GLUCOSE CONTENT MEASUREMENT IN DIABETES PATIENTS. *ANTHONY PORTELLA*, UNIVERSITY OF SOUTH ALABAMA.

Very accurate measurement of blood glucose levels in diabetes patients is very critical. The current method of needle-based measurement is a painful experience for patients, who require multiple measurements in a day. Recently there has been renewed interest in development of other techniques, such using human saliva for glucose level measurements, thereby eliminating the need for needle-based tests. Recently a prism-fiber configuration has been used to increase the sensitivity of glucose level indicator in human saliva and we propose to use graphene based detector methodology to excite the glucose level indicator for an accurate representation of the glucose level presence in human saliva.

OPTIMIZING SPEED AND SENSITIVITY OF AN LED-BASED HYPERSPECTRAL IMAGING SYSTEM. ***PHIWAT KLOMKAEW*****, SAM MAYES, THOMAS RICH AND SILAS LEAVESLEY, UNIVERSITY OF SOUTH ALABAMA.**

Our lab has worked to develop high-speed hyperspectral imaging systems that scan the fluorescence excitation spectrum for biomedical imaging applications. Hyperspectral imaging can be used in remote sensing, medical imaging, reaction analysis, and other applications. Here, we describe the development of a hyperspectral imaging system that comprised an inverted Nikon Eclipse microscope, sCMOS camera, and a custom light source that utilized a series of high-power LEDs. LED selection was performed to achieve wavelengths of 350-590 nm. To reduce scattering, LEDs with low viewing angles were selected. LEDs were surface-mount soldered and powered by an RCD. We utilized 3D printed mounting brackets to assemble all circuit components. Spectraradiometric calibration was performed using a spectrometer (QE65000, Ocean Optics) and integrating sphere (FOIS-1, Ocean Optics). Optical output and LED driving current were measured over a range of illumination intensities. A normalization algorithm was used to calibrate and optimize the intensity of the light source. The highest illumination power was at 375 nm (3300 mW/cm^2), while the lowest illumination power was at 515, 525, and 590 nm (5200 mW/cm^2). Comparing the intensities supplied by each LED to the intensities measured at the microscope stage, we found there was a great loss in power output. Future work will focus on using two of the same LEDs to double the power and finding more LED and/or laser diodes and chips around the range. This custom hyperspectral imaging system could be used for the detection of cancer and the identification of biomolecules.