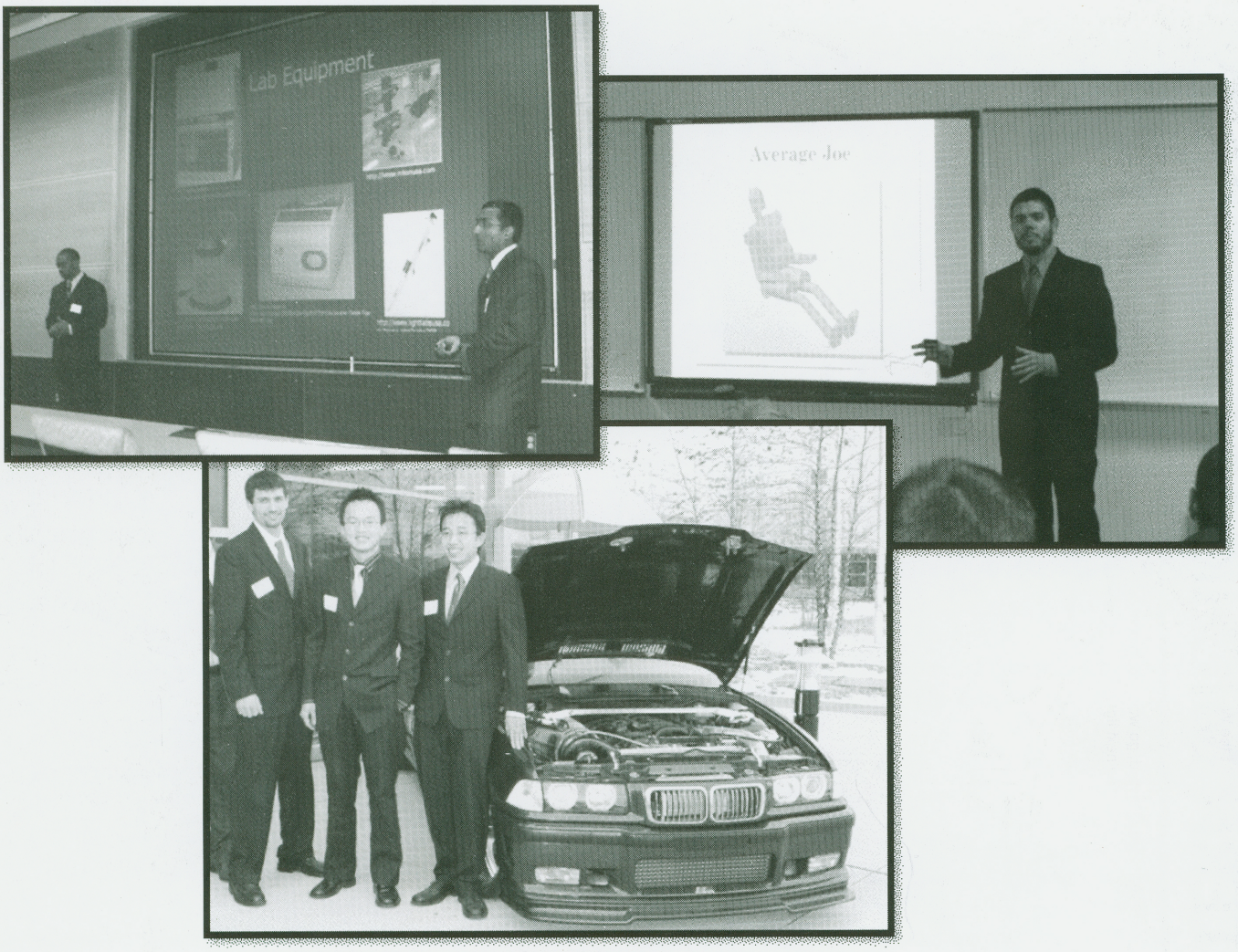
4-2008

42nd Conference on Senior Engineering Design Projects

College of Engineering and Applied Sciences



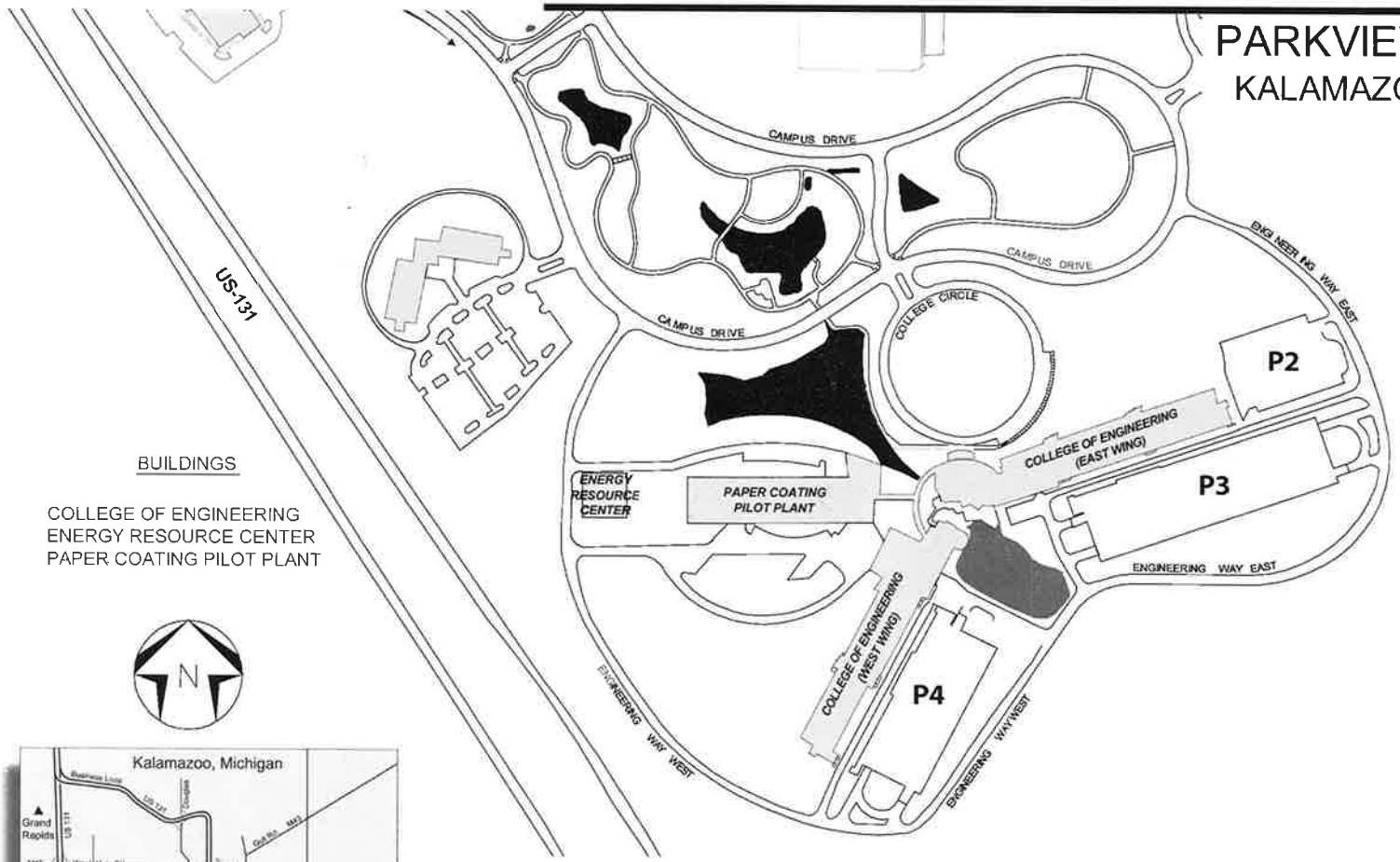
42nd Conference on
Senior Engineering Design Projects

Tuesday, April 15th, 2008, 8 am to 4 pm
College of Engineering and Applied Sciences
Parkview Campus

WESTERN MICHIGAN UNIVERSITY

WESTERN MICHIGAN UNIVERSITY

PARKVIEW CAMPUS
KALAMAZOO, MICHIGAN



BUILDINGS

COLLEGE OF ENGINEERING
ENERGY RESOURCE CENTER
PAPER COATING PILOT PLANT

0 100 300 500

SCALE IN FEET

--Directions--

From I-94
At exit #74, turn north onto U.S. 131, go 2.8 miles, follow the directions listed below for U.S. 131.

From U.S. 131
At exit #36A, turn east onto Stadium Drive. Turn right at first light which is Drake Rd. Continue on Drake Rd. through the next light (at Parkview Ave.) into the WMU Parkview Campus. You will now be on Campus Drive.

From WMU Main Campus
From the corner of Stadium Dr. and Howard, go west on Stadium Dr. until you come to Drake Rd. Turn left onto Drake and continue south through the next light (at Parkview Ave.) and into the WMU Parkview Campus. You will now be on Campus Drive.

WMU PHYSICAL PLANT
July 2004 by E Dantes, B.Morris

Conference on Senior Engineering Design Projects

You are invited to attend the forty-second Conference on Senior Engineering Design Projects. The conference will be held from 8 a.m. to 4:00 p.m., **Tuesday, April 15th, 2008** at the College of Engineering and Applied Sciences on the Parkview Campus of Western Michigan University. The College of Engineering and Applied Sciences sponsors the conference to showcase the work of its graduating seniors, who are required to complete a capstone project that puts into practice what they have learned. Many of the projects are sponsored by business and industry. The conference is **free** and open to the public. You are welcome to attend all or part of the day's events. Reservations are not necessary.

High school and community college teachers are encouraged to bring students to the conference. Buses can drop off passengers in the College Circle in front of the building and then park in lot P-2. (See map)

Teachers who cannot accompany their students to the conference may ask their students to sign in and out at the information table in the lobby on the first floor of the College. Sign-in sheets will be mailed to teachers the day after the conference.

Parking is available in the ramps behind the College of Engineering and Applied Sciences (See Map: Lots P3 and P4). There is no charge for parking for those attending the Conference.

Presentations begin on the hour and half hour. Please do not enter a room after a presentation has begun.

Session locations, times, and page number for project descriptions:

Civil and Construction Engineering	D-115	9 a.m. to 2 p.m.	p. 5
Computer Science	D-210	10 a.m. to 1:30 p.m.	p. 8
Electrical and Computer Engineering	D-202	9 a.m. to 11:30 a.m.	p. 10
Industrial Design	D-109	9 a.m. to 4 p.m.	p. 11
Industrial and Manufacturing Engineering	D-201	8 a.m. to 2:30 p.m.	p. 16
Mechanical and Aeronautical Engineering A	D-204/5	9 a.m. to 3:00 p.m.	p. 19
Mechanical and Aeronautical Engineering B	D-124	9 a.m. to 12 p.m.	p. 23
Mechanical and Aeronautical Engineering C	D-212	9 a.m. to 1:30 p.m.	p. 25
Paper Eng., Chemical Eng., and Imaging	D-208	10 a.m. to 3 p.m.	p. 27

A **lunch** break is scheduled from 12 p.m. to 1 p.m. There is a café available on site.

For more information about the conference, call Laura Decker at (269) 276-3251.

CCE Civil and Construction Engineering
CS Computer Science
ECE Electrical and Computer Engineering
ID Industrial Design
IME Industrial and Manufacturing Engineering
MAE Mechanical and Aeronautical Engineering
PCI Paper Engineering, Chemical Engineering, and Imaging

Time	Room	Dept.	Topic
8:00	D-201	IME	Implementation of a Vehicle Road Load Simulator
8:30	D-201	IME	Developing a Control System for Inventory Storage Containers
9:00	D-115	CCE	Stadium Hotel
	D-202	ECE	Solar Car LED Traffic Safety Light System with CAN Interface
	D-109	ID	Patient Transfer Aid
	D-201	IME	Redesign of Hospital Café Operations
	D-204	MAE A	Redesign of a Patient Lift System
	C-124	MAE B	Buoyancy Driven Flow in an Automotive Underhood
	D-212	MAE C	Vision Based Roll Stabilization of an Unmanned Aerial Vehicle
9:30	D-115	CCE	80,000 sq. ft. Manufacturing Facility
	D-202	ECE	Sunseeker Telemetry and Data Logging Unit
	D-109	ID	Patient Fall Prevention
	D-201	IME	Developing Moisture Content, Volatility, and Loss on Ignition Sand Test
	D-204	MAE A	Design of a Human Lift System
	C-124	MAE B	SAE Supermileage Vehicle Design
	D-212	MAE C	Advanced Design Wind Tunnel Control and Data Acquisition
10:00	D-115	CCE	New Elementary School
	D-210	CS	CRF Entry System
	D-202	ECE	Surgical Console Data Interface
	D-109	ID	Overbed Transfer Device
	D-201	IME	Using Casting Simulation Software to Examine Internal Shrinkage of Junction Designs
	D-204	MAE A	Design Modification of Tricycle
	C-124	MAE B	Midget Car Chassis Design
	D-212	MAE C	Propeller Thrust Efficiency Analysis and Test Bench Design
	D-208	PCI	Effect of Line Angle on Conductivity of Gravure Printed Electronics
10:30	D-115	CCE	Zion Lutheran Church Additions and Renovations
	D-210	CS	Order Processing Software
	D-202	ECE	Muscular Reflex Response Measurement System
	D-109	ID	Same Day Surgery Table
	D-201	IME	A Small-batch, High-temperature Plastic Powder Compounding System
	D-204	MAE A	Design Enhancements to Hand Powered Cycle
	C-124	MAE B	Thermoelectric Waste Heat Recovery
	D-212	MAE C	Ducted Fan Propulsion
	D-208	PCI	Low Cost Fiber Alternative
11:00	D-115	CCE	Downtown Kalamazoo Riverfront Development
	D-210	CS	Wind Turbine Data Acquisition System
	D-202	ECE	Emergency Vehicle Radio Control Device
	D-109	ID	Disaster Preparedness in Medicine and Search and Rescue

	D-201	IME	Redesign of Side Rail Systems for Hospital Beds
	D-204	MAE A	Method of Attaching Porous Titanium for Orthopedic Implants
	C-124	MAE B	Design of a Solar Thermal System
	D-212	MAE C	Joined Wing Light Sport Aircraft Design
	D-208	PCI	Cooling Tunnel Optimization
11:30	D-115	CCE	Six Story Green Office Building
	D-210	CS	Sunseeker Performance Model
	D-109	ID	Bed to Wheelchair Transfer Device
	D-201	IME	Analysis of Delivery and Circulation of a Newspaper
	D-204	MAE A	Product Pump System Design
	C-124	MAE B	Design of Fabricated Steer Axle Beam for Commercial Vehicles
	D-212	MAE C	Ultralight Aircraft Design and Construction
	D-208	PCI	Energy Losses in Industrial Baking Ovens
1:00	D-115	CCE	Semi-Pro Baseball Stadium
	D-210	CS	Modeling the Spread of Early Christianity
	D-109	ID	POURfect Juicer
	D-201	IME	Redesign of a School's Pick-up and Drop-off System
	D-204	MAE A	Design of a Flexible Test Cell
	D-212	MAE C	Turbulent Flow Turbine Design
	D-208	PCI	Melengestrol Acetate Process Improvement
1:30	D-115	CCE	Three Story Office Building
	D-109	ID	Robotic Auto Exhibit
	D-201	IME	Design and Optimization of a Human-powered Hydraulic Bicycle
	D-204	MAE A	Washer Water Delivery System Redesign
	D-208	PCI	Closed Loop Cooling System for Fermentation Tanks
2:00	D-109	ID	The Concrete Shift
	D-201	IME	Re-engineering of Automotive Subsystems Phase III
	D-204	MAE A	The Analysis and Redesign of a Steam Trap
	D-208	PCI	Displacement Distillation Optimization
2:30	D-109	ID	Aluminum Outdoor Chaise Lounge
	D-204	MAE A	High Flow Rate Water Delivery System
	D-208	PCI	Energy Tracking and Control
3:00	D-109	ID	Fire Hydrant Redesign
3:30	D-109	ID	Powerboat Suspension Design

THANK YOU

The College of Engineering and Applied Sciences is grateful to these sponsors that have provided or cooperated in Senior Engineering Design Projects being presented in April 2008. If you have a project for our students or if you would like more information, please call Laura Decker at (269) 276-3251.

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CIVIL AND CONSTRUCTION ENGINEERING
Session Chair – Sherif Yehia
Room D-115

STADIUM HOTEL
by Jon Beythan, James Butler, and Tom Clevenger
Sponsor: Rex Milliron, Prein & Newhof
Faculty Advisors: Jun-Seok Oh and Sherif Yehia
9:00 a.m. to 9:25 a.m., Room D-115

The increase of businesses in Kalamazoo County has caused the need for hotel facilities in the area. Building design was done with hand calculations along with various engineering computer programs such as SAP2000 v11, SimTraffic, and Synchro 7. The design was completed in compliance with the appropriate codes and specifications. In addition, a traffic impact study was conducted to evaluate the conditions before and after project completion. The newly completed project will increase the amount of affordable short time housing and will also promote further business in the area.

80,000 SQ. FT. MANUFACTURING FACILITY
by Adam Dudek, Riley King, and Brock Mellema
Sponsor: John Kakoczki, CSM Group
Faculty Advisor: Ahmad Jrade
9:30 a.m. to 9:55 a.m., Room D-115

One of the nation's leading manufacturers of steering wheels, air bags, and shift levers was in need of expanding their manufacturing facilities. A design was created for a new 80,000 sq ft facility to satisfy the growing needs of the company. In order for construction to begin it required the creation of a detailed cost estimate and schedule using timberline estimating and primavera scheduling software. A safety plan was also created to insure the proper procedures were taken in the case of any accident that may have occurred during construction. This expansion allowed the company to increase its productivity and efficiency.

NEW ELEMENTARY SCHOOL
by Michael Meyer, Jason Raleigh, and Michael Romkema
Faculty Advisors: Jun-Seok Oh and Sherif Yehia
10:00 a.m. to 10:25 a.m., Room D-115

The introduction of the Kalamazoo Promise has resulted in an increase in the number of students enrolled at Kalamazoo Public Schools, and is expected to continue to grow. Therefore, a new elementary school building is needed for grades K-5. It is projected that 400 students will occupy the new school building with about 65 students per grade. The building houses a library, music room, art room, computer lab, offices, restrooms, and a gymnasium that doubles as a cafeteria, as well as other basic needs. A computer model was generated to analyze the structural design of the new school building and the results of the model were verified by hand calculations. In addition, a traffic impact study was performed to assess the impacts of the increased population due to the new school.

ZION LUTHERAN CHURCH ADDITIONS AND RENOVATIONS
by Matt Begeman, Ron Donkersloot, Brian Iskra, and Tim VanStraten
Sponsor: Jack Abate, Miller-Davis Company
Faculty Advisor: Hubo Cai
10:30 a.m. to 10:55 a.m., Room D-115

Expanding needs at Zion Lutheran Church have lead to plans for a 9200 sq ft addition and several renovations. A phasing plan was established that allowed the church to keep occupancy during the construction process. Work items were identified for each phase and were used to generate a detailed estimate and project schedule utilizing Microsoft Project and custom design spreadsheets. A variability analysis was performed to identify possible impacts on project duration. To help maintain a safe and successful project, a project management system was developed including a safety plan and applicable reporting forms.

DOWTOWN KALAMAZOO RIVERFRONT DEVELOPMENT
by Jared Champayne, Matthew Czachowski, and Marjorie VanHoorelbeke
Faculty Advisor: Sherif Yehia
11:00 a.m. to 11:25 a.m., Room D-115

The Riverfront Redevelopment Plan calls for a change from the industrial past to a new, modern philosophy called "Work-Live-Play". It will be replacing designated Brownfield development with trendy public space along the river. Accordingly, a new commercial mixed-use building was designed incorporating restaurant and retail areas on the first floor, with available office rental space on the upper floors. The multi-story building was designed using SAP 2000 and a traffic impact study was performed using Synchro traffic analysis software. The structure will positively expand the economy of the downtown Kalamazoo area.

SIX STORY GREEN OFFICE BUILDING
by Scott Baker, Andrew Kuipers, and Sean Lynn
Faculty Advisors: Sherif Yehia and Jun-Seok Oh
11:30 a.m. to 11:55 a.m., Room D-115

With Michigan's slumping economy office buildings can be vital for supplying jobs and boosting the local economy. A full structural plan and analysis were performed using SAP2000 to ensure structural stability and longevity. Green building criteria was incorporated into the design to reduce environmental impact. Incorporating SimTraffic, a traffic impact study for the corridor was performed to emulate traffic flow and proper operation. The completed office structure will provide a greater quality of life for the community by supplying more jobs and being environmentally friendly.

SEMI-PRO BASEBALL STADIUM
by Philip Reitenour, William Rizor, and Jonathon Smith
Faculty Advisors: Sherif Yehia and Jun-Seok Oh
1:00 p.m. to 1:25 p.m., Room D-115

Semi-pro baseball has been a part of the Kalamazoo area for years. In order to improve attendance and accessibility, a piece of farmland was developed to house a semi-pro baseball stadium. A site plan was designed based on existing topography that utilizes the site to its greatest extent while providing adequate drainage and convenient access. All structural components of the stadium were designed and analyzed with the aid of computer programs such as SAP2000, AutoCAD, and RISA3D. Traffic components were designed and impact study was performed using SYNCRO. The culmination of this project will provide the community with a feasible development idea that will greatly enhance the surrounding area.

THREE STORY OFFICE BUILDING
by Roscoe Serrels, Blake Sheffler, and Brandon Widmyer
Faculty Advisor: Ahmad Jrade
1:30 p.m. to 1:55 p.m., Room D-115

Brighton, Michigan is the fastest growing segment of Livingston County, Michigan. Due to the increasing population and vast range of job opportunities, a new office building was developed. The successful completion of the project was accomplished by creating a comprehensive quantity take off, detailed cost estimate and schedule, and a thorough construction safety plan. The developed office building was built on top of 3.24 acres of land and has a total area of 44,151 sq ft, consisting of three separate levels. The development of this new office building will help create new job opportunities around the city of Brighton and provide expansion opportunities due to the ongoing demand of the increasing population.

COMPUTER SCIENCE
Session Chair – John Kapenga
Room D-210

CRF ENTRY SYSTEM

by Matt Ackerman and Sahana Pindikuri
Sponsor: Dr. Karen Woodin, JKK Consulting
Faculty Advisor: John Kapenga
10:00 a.m. to 10:25 a.m., D-210

An application was designed to manage the collection and entry of Case Report Forms (CRFs) filled out during clinical trials. Three pieces were created to accomplish this. First, the system uses XML specification files to create graphical entry screens that mimic CRFs. Second, tools were created to transform output data files into a format capable of being imported into spreadsheets or a database. Third and finally, a layer was developed for managing a complete set of CRFs defined for a trial, displaying the current entry status of those CRFs by clinical subject, and allowing new data entry or corrections.

ORDER PROCESSING SOFTWARE

by Anthony Mattas and Heather Watson
Sponsor: Greg McCormick, Stryker Craniomaxillofacial
Faculty Advisor: John Kapenga
10:30 a.m. to 10:55 a.m., D-210

Java Enterprise Edition 5 was utilized to develop a software framework that allows for the transmission and access of information associated with inventory, customers, sales representatives, and orders across a network connection. Sales and customer service personnel can access this information through a web browser for order processing and queries. Order confirmation e-mails can be sent automatically to sales representatives and customers upon successful completion of an order. This software will serve to manage these transactions easily and efficiently.

WIND TURBINE DATA ACQUISITION SYSTEM

by Joseph Ellis and Roger Jones
Faculty Advisor: John Kapenga
11:00 a.m. to 11:25 a.m., D-210

The Wind Turbine Data Acquisition System was written to collect and archive data from the WMU Parkview Campus wind turbine. A major goal was to advertise the effectiveness of wind power. This system of applications processes data from the wind turbine sent by radio link. In addition, the system manages and records this data into a MySQL database. There is a website to conveniently view this data using php, html, and javascript. The system also handles data from a weather station.

SUNSEEKER PERFORMANCE MODEL
by Brad De Young, Dan Janssen, and Kyle Kolasinski
Faculty Advisor: John Kapenga
11:30 a.m. to 11:55 a.m., D-210

An application was built to predict and display the performance of the Sunseeker car during a solar car race. The application was built upon an existing model originally written by members of the Sunseeker team. The model inputs sunlight, speed limit, latitude, longitude and altitude, and outputs the speed to travel and energy in the car. During the race, these predicted values are plotted against the real-time values being pulled from the car. The user can then re-adjust the model if needed to compute a better performance model. The application also attempts to compute an optimal performance model.

MODELING THE SPREAD OF EARLY CHRISTIANITY
by Aaron Brandt, Sasson Jamshidi, and Simon Tower
Faculty Advisor: John Kapenga
1:00 p.m. to 1:25 p.m., D-210

A computer program was written to simulate the spread of early Christianity in the Holy Roman Empire using a base program written in Visual Basic. In order to promote portability and usability, the program was re-written in Java. Extensions include a graphical user interface, region focus, and a spread bias for Christianity. The model allows for different area sizes, time spans, and spread chances. The program may be used to model the spread of any other cultural element and may be used on any system that supports Java.

ELECTRICAL AND COMPUTER ENGINEERING
Session Chair – John Gesink
Room D-202

SOLAR CAR LED TRAFFIC SAFETY LIGHT SYSTEM WITH CAN INTERFACE

by Mark Jochum, Michael McCabe, Aaron Rose, and Russell Schoenbeck
Faculty Advisor: Liang Dong
9:00 a.m. to 9:25 a.m., Room D-202

The WMU solar car team is designing a new car with a control area network (CAN) backbone and needs a new LED traffic safety light system. This system consists of a control board, front and rear turn signals, rear brake lights, and an overhead caution light. The control board contains a CAN transceiver, a microcontroller, and LED driver chips. The completed design will aid the solar car team in its mission to demonstrate the efficient power usage in a concept car as well as the use of alternative renewable energy for everyday consumer travel.

SUNSEEKER TELEMETRY AND DATA LOGGING UNIT

by Steven Ballard, Stephen Beerbower, Michael Lowary, and Andre Williams
Faculty Advisor: Bradley Bazuin
9:30 a.m. to 9:55 a.m., D-202

The Sunseeker solar car team required a custom telemetry unit to collect electrical and mechanical data on the car's performance and transmit it wirelessly to a chase vehicle. A microcontroller based system was designed, built, and tested to collect information from the car's CAN bus, provide a time stamp and formatting, and then transmit the data using a long-range radio data modem. The unit can also write the time-stamped data onto an external USB memory stick for later analysis. The unit is based on a Texas Instruments MSP 430 microcontroller with separate interfaces for the CAN bus, USB device, and an RS-232 modem connection. Wireless transmission was accomplished using a 900 MHz ISM band RF Modem from Digi International.

SURGICAL CONSOLE DATA INTERFACE

by Brandon Enright, Matthew Terry, and Nuthanael Watkins
Sponsor: Brandon Enright, Stryker Instruments
Faculty Advisor: Dean Johnson
10:00 a.m. to 10:25 a.m., D-202

A Data Storage Interface (DSI) has been designed and built which will serve as a communications interface between the Stryker Neurospine Electrosurgical Console (NESC) and a personal computer. The NESC uses radio frequency signals to perform an invasive procedure used for treatment of back pain. The DSI will capture and write data over an I^2C bus via the use of a microcontroller and consoles parallel port. The captured data will be processed by the microcontroller and written to a Secure Digital (SD) media card for later analysis.

MUSCULAR REFLEX RESPONSE MEASUREMENT SYSTEM
by Muhammad Farhan Azhar, James Havlik, and Ishrak Mamun
Sponsor: Ralph Robertson, R.S. Designs
Faculty Advisor: Ikhlas Abdel-Qader
10:30 a.m. to 10:55 a.m., D-202

A Muscular Reflex Response Measurement System was designed to measure reflex actions of an individual. An abnormal reflex action may indicate an existing back injury. This system electronically records the reflex action using electrode pads placed on the calf muscle. These electronic records make for easy file sharing of the reflex waveform. The reflex is generated when the test subject's Achilles tendons are struck with a reflex hammer. This invention allows employers and insurance companies to create existing records of a person's reflex actions.

EMERGENCY VEHICLE RADIO CONTROL DEVICE
by Brian DeVries, David Frank, and Daniel Heider
Faculty Advisor: Debbie Dawson
11:00 a.m. to 11:25 a.m., D-202

A new device to aid drivers during emergency driving has been envisioned. The device interfaces an emergency vehicle's radio to steering wheel mounted and voice operated controls. The device concept significantly minimizes the distraction of having to control a radio and frees a driver's hands for the more imperative task of driving. The device circuitry will be designed, and a model produced to serve as a prototype for the further development of a device that will make emergency driving safer.

INDUSTRIAL DESIGN
Session Chair – Roman Rabiej
Room D-109

PATIENT TRANSFER AID
by Michael Seeley
Sponsor: Marty Stryker, Stryker Medical
Faculty Advisor: Roman Rabiej
9:00 a.m. to 9:25 a.m., D-109

Various problems throughout a patient transfer are evident through both the view of the patient and that of the nurse. Both encounter many ergonomic and psychological hardships throughout the procedure. Improving these conditions not only increases hospital efficiency, but more importantly, the overall comfort, health, and safety of both the patient and nurse. Though many devices have been developed to aid in, and improve these processes, an abundance of variables prevent any one idea from solving them all at any one time. Intensive observation and analysis of current products, processes, environments, and user needs led to the merging of two very diverse, independent pieces of medical equipment to solve the overall problem of the wheelchair and medical bed existing as separate products in the first place.

PATIENT FALL PREVENTION
by Chris Iley, Jeff Michalak, and Rury Vizcarra
Sponsors: Marty Stryker and Jason Wroblewski, Stryker Medical
Faculty Advisors: Roman Rabiej and Doug Wolff
9:30 a.m. to 9:55 a.m., D-109

Patient falls are the leading cause of injury-related death for people who are 65 years of age and older. Falls lead to severe injuries including fractures and brain trauma as well as invoking a fear of falling itself. Using the design methods, a product was developed which can be easily implemented and integrated into the health care environment to reduce the number of injuries from falls. The new walker system is intended to help promote independence and confidence while preventing fall-related incidences.

OVERBED TRANSFER DEVICE
by Joseph Kelly and Matthew Lewis
Sponsors: Marty Stryker and Jason Wroblewski, Stryker Medical
Faculty Advisors: Roman Rabiej and Doug Wolff
10:00 a.m. to 10:25 a.m., D-109

Overbed lifts are used in an acute care hospital environment for moving patients who are either too ill or too heavy for nurse-assisted transfer. Through research and hands-on experience, focusing on patient interface, the final concepts use new methods of lifting a patient. From scooping up a patient to incorporating the patient's bed sheet, the concepts allow a caregiver to use the lift with less stress for the caregiver and patient by making the task more efficient both aesthetically and more pleasant functionally for patient and caregiver.

SAME DAY SURGERY TABLE
by Justin Edwards, Katelin Elms, and Kyle Mattingly
Sponsors: Marty Stryker and Jason Wroblewski, Stryker Medical
Faculty Advisors: Roman Rabiej and Doug Wolff
10:30 a.m. to 10:55 a.m., D-109

Outpatient surgeries today are at an all time high, with over 60% of today's elective surgery procedures in the USA being performed as outpatient surgeries. Health experts expect this percentage to grow to nearly 75% within a decade. To aid these surgeries, an outpatient surgical table was created using Rhinoceros, a 3D modeling software package. Modeling allows for better visualization of the product, as well as offering the ability to study problematic areas of concern with less invasive surgical techniques.

DISASTER PREPAREDNESS IN MEDICINE AND SEARCH AND RESCUE
by Benjamin Moulton
Sponsor: Stryker Corporation
Faculty Advisors: Roman Rabiej and Doug Wolff
11:00 a.m. to 11:25 a.m., D-109

Disaster preparedness has become a primary issue of importance in the medical profession and within governmental agencies. The design solution is the creation of a modular safety harness system. The harness is designed for carrying equipment and preventing spinal and other injuries to medical and rescue personnel working in adverse and often deadly environments. The harness will allow rescuers to perform their jobs more safely. This will result in a higher quality of care to victims and increasing their probability of survival.

BED TO WHEELCHAIR TRANSFER DEVICE
by Yukiko Kawano, McGregor Robertson, and Jimmar Wilson
Sponsor: Marty Stryker and Jason Wroblewski, Stryker Medical
Faculty Advisors: Roman Rabiej and Doug Wolff
11:30 a.m. to 11:55 a.m., D-109

Current patient transfer methods often place medical personnel in awkward and exhausting positions when transferring patients from medical beds to wheelchairs and vice versa. The disparity in patient size and mobility can further complicate matters. An innovative patient transfer device was designed, with input from nursing personnel, giving special consideration to ergonomics, materials, and the medical environment. A three-dimensional model was created to provide a healthier and more effective way of patient transfer, in turn reducing mental as well as physical stresses, for both nurses and medical patients.

POURFECT JUICER
by August Jacobson
Sponsor: Randy Kass, POURfect Products
Faculty Advisors: Roman Rabiej and Doug Wolff
1:00 p.m. to 1:25 p.m., D-109

Hand citrus juicers seem like they are accessible at nearly every store that sells houseware products. However, juicers are quite standardized in how they function. Problems such as breaking, unstable parts, and juice spray are common among certain types of models as well. Studies of juice flow and device flaws were assessed to create a new model of citrus juicer. From the new ideas, a series of hand juicers were designed to a family of products which are currently manufactured. The designs incorporate function and usability while saving time and costs by utilizing previously designed products.

ROBOTIC AUTO EXHIBIT
by Adam Thomas
Sponsor: Mike Clark, Mannetron: Entertainment Robotics
Faculty Advisors: Roman Rabiej and Doug Wolff
1:30 p.m. to 1:55 p.m., D-109

Auto shows provide a great opportunity to acquire customer feedback while supplying entertainment and, with today's technology, exhibits now need to be more than just static displays. The Robotic Auto Exhibit is a fully interactive display which is capable of gaining user information through a short touch screen survey, teaching patrons about current automotive technology, and creating an exciting show through the use of robotics, lights, and sound. The display also creates a tangible handout with a forged-in logo.

THE CONCRETE SHIFT
by James Torrey
Sponsor: Chris Cyndergaard, The Woodsmiths, Inc.
Faculty Advisors: Roman Rabiej and Doug Wolff
2:00 p.m. to 2:25 p.m., D-109

Concrete is rarely thought of as a comfortable, aesthetically pleasing material and therefore almost never seen incorporated into furniture. In fact it is often considered a cold, rough, and heavy substance unsuitable for use in household applications altogether. Used correctly however concrete can achieve an aesthetically pleasing appeal similar to stone or ceramic surfaces. To demonstrate this, a contemporary coffee table has been designed, the Concrete Shift, which incorporates concrete with environmentally friendly wood products and manufacturing practices.

ALUMINUM OUTDOOR CHAISE LOUNGE
by Joshua Watson
Sponsor: Tom Jacobs, Max Docks Company
Faculty Advisors: Roman Rabiej and Doug Wolff
2:30 p.m. to 2:55 p.m., D-109

Outdoor furniture is often difficult to maintain or susceptible to breaking due to the nature of the materials used. Utilizing aluminum as a material allowed for resistance to weathering and damage, and created a strong and unique chaise lounge chair. A model was created to display the simplicity, strength, and adjustability of the piece. It was designed to allow it to be RTA (ready to assemble) for easy transportation and disassembly for storage or recycling. Durability, adjustability, and striking visual aesthetics make the chaise not only a comfortable piece of furniture, but also a sculptural piece.

FIRE HYDRANT REDESIGN
by Jon Cervin
Faculty Advisors: Roman Rabiej and Doug Wolff
3:00 p.m. to 3:25 p.m., D-109

Current fire hydrants in use today have not been updated since their introduction in the late 1800's. Their archaic design does not consider new threats to society, tampering from the public, or serviceability and usage issues. With an emphasis on new materials, technology, and aesthetics, a hydrant concept was conceived that would address firefighter's needs, as well as societal issues. The new design is easier to manufacture and more reliable than the standard hydrant. Also, the concept solves many issues firefighters face when responding to an emergency, resulting in more efficient fire suppression.

POWERBOAT SUSPENSION DESIGN
by Adam Dudycha
Faculty Advisors: Roman Rabiej and Doug Wolff
3:30 p.m. to 3:55 p.m., D-109

Powerboats in today's market are, for the most part, still using century old design. Technology has advanced 100 fold since the first powerboat hit the water. With the advent of suspension technology being utilized in every aspect of motorized sports, emphasis was placed on incorporating suspension into the marine industry. Along with the adaptation of suspension into powerboats, green design was utilized with the addition of eco-friendly materials as well as advanced hydrogen fuel cell technology. With these technological additions to the marine design industry, the leisure sport of power boating will secure its foothold in the future to come.

INDUSTRIAL AND MANUFACTURING ENGINEERING
Session Chairs – Betsy Aller and Bob White
Room D-201

IMPLEMENTATION OF A VEHICLE ROAD LOAD SIMULATOR
by Thomas Sutton
Faculty Advisors: James VanDePolder and Joe Petro
8:00 a.m. to 8:25 a.m., D-201

Emissions from mobile sources such as the modern automobile have become an environmental as well as a political concern in the United States. Using Computer Aided Design software and Computer Aided Manufacturing techniques, a Clayton Industries chassis dynamometer has been made operational. Using vehicle inertia simulation and eddy current absorber, road loads can be simulated in the laboratory. Computer integration methods were used to develop software to control the dynamometer systems. This system will permit research in the areas of alternative fuels and advanced engine systems.

DEVELOPING A CONTROL SYSTEM FOR INVENTORY STORAGE CONTAINERS
by Alex Bakos, Dave Baxter, Shawna Poncil, and Matt Spenceley
Sponsor: Michael Wiersma, Perrigo Company
Faculty Advisor: David Lyth
8:30 a.m. to 8:55 a.m., D-201

Lack of control over inventory storage containers can result in downtime, confusion, and ultimately a loss in productivity. A pull system using signaling to indicate when containers are needed downstream was created to make the process more systematic and efficient. ProModel and time studies were used to simulate the flow of the containers throughout the facility to determine where improvements could be made, and a cost analysis was performed. The completed model will provide greater control and allow for more effective use of the storage containers.

REDESIGN OF HOSPITAL CAFÉ OPERATIONS
by Paul Boudro, James Nokielski, Erik Starkey, and Andrew Toland
Sponsor: Grant Fletcher, Bronson Methodist Hospital
Faculty Advisor: Kailash Bafna
9:00 a.m. to 9:25 a.m., D-201

A prominent hospital's Terrace Café has experienced a greater number of customers than it was designed to accommodate. This overflow resulted in lengthened customer wait time, crowded hallways, and decreased customer satisfaction throughout the day, especially during peak times. Layout, flow, and ergonomics were studied and time studies were conducted to improve the operations. An improved floor layout and equipment recommendations were evaluated and developed to address these issues.

DEVELOPING FIVE MINUTE MOISTURE CONTENT, VOLATILITY, AND LOSS ON IGNITION SAND TEST

by Kyle Beyer, William Ruhl, and Nathan Stemple
Faculty Advisors: Sam Ramrattan and Pavel Ikonomov
9:30 a.m. to 9:55 a.m., D-201

The metal casting industry currently spends excessive time performing sand testing procedures. If quick information about sand composition is needed, a faster, more real-time method of testing is necessary. Three standardized American Foundry Society sand tests have been manipulated and combined into one simple testing procedure, without compromising accuracy. By implementing an induction furnace, testing time has been reduced from three hours to only five minutes. The reduction in time will greatly increase the effectiveness of these three tests, enabling industry to make real-time changes when needed.

USING CASTING SIMULATION SOFTWARE TO EXAMINE INTERNAL SHRINKAGE OF JUNCTION DESIGNS

by Aaron Copeland, Lauren Lambert, and Jessica Liptov
Faculty Advisors: Sam Ramrattan and Jorge Rodriguez
10:00 a.m. to 10:25 a.m., D-201

Shrinkage porosity in a metal casting results from the way it solidifies. Industry tries to eliminate shrinkage because it affects the integrity and aesthetics of the cast part. Three-dimensional models of simple junction designs were created with Pro/Engineer software, and their shrinkage behavior was studied using NovaFlow and NovaCast solidification simulation software. Actual molds were also constructed of the same junction designs; the resulting parts were cut and studied to look for porosity. The porosity results from the actual castings were then compared to the theoretical simulation findings. Recommendations based on these comparisons were made to eliminate shrinkage defects.

A SMALL-BATCH, HIGH-TEMPERATURE PLASTIC POWDER COMPOUNDING SYSTEM

by Anthony Brooks, Courtney Rawlings, and James Vlieg
Faculty Advisors: Paul Engelmann and Betsy Aller
10:30 a.m. to 10:55 a.m., D-201

Blending plastics with additives compounding in an industrial setting requires a large amount of material. Because of high material costs of plastics, it is desirable in a research setting to have the capability to compound in small batches. A small-batch compounding system with high-temperature capabilities was implemented, consisting of a small scale mixing machine and processing equipment. The custom mixing machine was designed, fabricated, and optimized to mix dry powdered plastics and additives with even particle dispersion before processing. This small-batch system allows more time-effective, economical, higher-quality compounding for researchers.

REDESIGN OF SIDE RAIL SYSTEMS FOR HOSPITAL BEDS
by Kevin Collins, James Plocinik, and Adam Tipton
Sponsor: Richard Derenne, Stryker Medical
Faculty Advisor: Jorge Rodriguez
11:00 a.m. to 11:25 a.m., D-201

In today's medical environment, patient transfer between beds is often difficult or even dangerous because of the gap created by side rail interference. A new side rail system was developed that eliminates this gap. Using Pro/Engineer, a parametric solid modeling software, three-dimensional models of the proposed solutions were created. Feasibility studies, finite element analyses, and cost analyses were used to evaluate each design. The final developed design is a safe, stowable, intuitive, and user-friendly side rail system for hospital beds.

ANALYSIS OF DELIVERY AND CIRCULATION OF A NEWSPAPER
by Trent Kenworthy, Ella Lambrix, Matthew Pridgeon, and Jason Saksewski
Faculty Advisors: Bob White and Azim Houshyar
11:30 a.m. to 11:55 a.m., D-201

Improving delivery routing and quantities is a specific target in the effort to reduce potential cost and waste in newspaper publishing. Simulation, forecasting, optimization, engineering economics, and inventory management are amongst the tools to achieve this targeted opportunity.

REDESIGN OF A SCHOOL'S PICK-UP AND DROP-OFF SYSTEM
by Ashley Bazzana, Shannon Bowerson, Alisha Hankins, and Ben Smith
Sponsor: Don Verkow, Paramount Charter Academy
Faculty Advisor: Steven Butt
1:00 p.m. to 1:25 p.m., D-201

A local K-8 charter school has experienced traffic congestion and excessive wait times during the morning drop-off and afternoon pick-up of students. Time studies were conducted to collect benchmarking data on the current system. ProModel, a simulation software package, was used to model the current system and potential re-design scenarios. Queuing theory and layout analysis techniques were utilized to develop proposed drop-off and pick-up systems. Evaluations were made on the different models to quantify savings and to derive recommendations. The proposed improvements are expected to alleviate traffic congestion and wait times while improving the safety of the school community.

DESIGN AND OPTIMIZATION OF A HUMAN-POWERED HYDRAULIC BICYCLE
by Robert Barden, Matthew Johnson, Vijay Moolan, and Daniel Switzer
Sponsor: Bob Dolwick, Parker Hannifin Corp.
Faculty Advisors: Alamgir Choudhury and Pavel Ikonomov
1:30 p.m. to 1:55 p.m., D-201

The previous generation of the human-powered hydraulic bicycle was the winner of last year's Chainless Challenge competition, and the only vehicle to complete the 12 mile endurance course. For this iteration a total redesign of the frame, steering, and hydraulic circuit was completed. The frame and steering were modeled using the 3D parametric modeling software, Pro/ENGINEER, and evaluated using the Finite Element Analysis software, Pro/MECHANICA. A hydraulic test bench was created that allowed for testing and evaluation of several different types of pumps and motors using electronic as well as manual data measurement. With the completion of the new design, the bicycle will be ready for the 4th annual competition in summer 2008.

RE-ENGINEERING OF AUTOMOTIVE SUBSYSTEMS PHASE III
by Marcus Anderson, Travis Fifelski, and Ryan Needham
Faculty Advisors: Fred Sitkins and Pavel Ikonomov
2:00 p.m. to 2:25 p.m., D-201

Automotive engineers continually improve products by using re-engineering and design practices to gain advantages over competitors. The design process was used in this third phase of a multi-part project to develop and produce electrical, fuel delivery, and cooling subsystems that ensure safety and functionality. Computer aided design (CAD) software and finite element analysis (FEA) were used to design and test various components included in the final design. The outcome was a unique, safety- and emissions-compliant, street legal 1949 Chevrolet truck.

MECHANICAL AND AERONAUTICAL ENGINEERING - A
Session Chair – Christopher Cho
Room D-204/205

REDESIGN OF A PATIENT LIFT SYSTEM
by Matthew Bair, Nicholas Peariso, and Michael Weiler
Sponsor: Michael Hugo, Stryker Medical
Faculty Advisor: Judah Ari-Gur
9:00a.m. to 9:25a.m., D-204/205

Hospitals do not currently have a lift system that will roll underneath all of their stretchers in order to give patients efficient care. The existing lift systems are too large. A smaller lift system was designed to facilitate its safe operation under all existing stretchers. This was accomplished through the use of computer design tools, such as Pro/Engineer and ANSYS, and rapid prototyping methods. Finite element analysis was performed on the redesigned base to determine the optimum configuration based on weight and stress distributions. The analysis and rapid prototyping validate the success of the new lift.

DESIGN OF A HUMAN LIFT SYSTEM
by Tim LaRoy
Faculty Advisor: Dennis VandenBrink
9:30a.m. to 9:55a.m., D-204/205

When an elderly or physically handicapped person is constrained to their bed, a serious problem of bedsores can develop. Accidents and injuries can also occur when attempting to physically lift the patient. A lift system was designed that would safely and easily reposition the patient in the bed and allow transfer to a wheelchair or other accessory. Software tools, including Pro/ENGINEER for solid modeling and ANSYS for finite element analysis, were used to verify a safe and efficient design. The ability to move a patient in three dimensions will prevent injuries to caretakers and provide greater freedom for the patient.

DESIGN MODIFICATION OF A TRICYCLE
by Jayasch Mannil, Giuseppe Messina, and Abe Panikulangara
Faculty Advisor: Daniel Kujawski
10:00a.m. to 10:25a.m., D-204/205

There are many individuals with disabilities which prevent their use of items many enjoy such as a simple bicycle. A tricycle with redesigned seat, brakes, handlebars, and pedals was designed which allows a user with disabilities to ride safely and comfortably. The model has a seatbelt to insure the rider is secure, pedal straps to insure the feet are not removed from the pedals, and handlebars altered to fit the user.

DESIGN ENHANCEMENTS TO HAND POWERED CYCLE
by John Bolhuis and Andrew Hyder
Faculty Advisor: James Kamman
10:30a.m. to 10:55a.m., D-204/205

It is difficult for a low-functioning disabled person to get adequate outdoor exercise. A commercially available three-wheeled hand powered cycle was modified to include remotely controlled braking and propulsion assistance. A drive mechanism was designed to provide low speed assist while introducing no additional drag to the vehicle while not engaged. A brake servomechanism was designed to provide emergency stop capabilities should the need arise. The system is intended to be lightweight, non-intrusive to normal operation, and easily fitted, offering greater levels of enjoyment and safety for both the rider and the caregiver.

METHOD OF ATTACHING POROUS TITANIUM FOR ORTHOPEDIC IMPLANTS
by Nicholas Horsmon and Conor Riordan
Faculty Advisor: Daniel Kujawski
11:00a.m. to 11:25a.m., D-204/205

One of the critical stages in the development of an orthopedic implant is to design a region for bony in-growth so that the implant can be well fixed to host bone. A previously developed porous titanium construct has already demonstrated the ability to sustain rapid bone in-growth. Focus was on methods of attaching the porous titanium to solid titanium alloy. Many concepts were explored and friction welding was found to be the most promising. Using this method, prototype test specimens were joined and subsequently destructively tested. Development of improved methods of incorporating porous titanium into orthopedic implants with an emphasis placed on friction welding processes was the end goal.

PRODUCT PUMP SYSTEM DESIGN
by Cody Leonard
Faculty Advisor: Richard B. Hathaway
11:30a.m. to 11:55a.m., D-204/205

A pump system used to supply product to a bottle filler on a pharmaceutical line was redesigned. The new system utilizes a positive displacement pump, a new control system, and new drives and controls that function within the operational limits of the filler. An ergonomic cart was created to make the pump easy to operate. The original pneumatic pump required frequent repairs and overhauls which affected line downtime. As a result of the consistency of the new pump system, line efficiency was improved.

DESIGN OF A FLEXIBLE TEST CELL
by Glenn Glidden, Nicholas Rouwhorst, and Tim Ulrich
Sponsor: D. A. Phaneuf**,** Humphrey Products Company
Faculty Advisor: Muralidhar Ghantasala
1:00p.m. to 1:25p.m., D-204/205

Pneumatic valves require testing to verify design integrity and provide performance certifications. Manual testing is currently used which requires continuous monitoring. To ease this testing procedure and to allow a variety of different valve styles to be tested, a flexible test cell was designed. A universal holding fixture for each product being tested was designed so that multiple fixtures would work with a single testing table. This involved the design and analysis of the processes and the sensors which determine the valve operational characteristics through LabVIEW. This system simplifies the testing procedure, making it more economical, by using the most recent instrumentation and measurement methods available.

WASHER WATER DELIVERY SYSTEM REDESIGN
by Diana Janke and Lauren Kmet
Sponsor: Mike Thursby and Mike Farrington, Whirlpool Corporation
Faculty Advisor: Iskender Sahin
1:30p.m. to 1:55p.m., D-204/205

The water delivery system for a washing machine is a key part in dispensing detergent and filling the tub. The detergent dispenser was redesigned to control flow in order to control splashing. The identification of key design components that contribute to splash was essential in developing the overall design. Flow analysis and experimentation were used to determine the best design alternatives.

THE ANALYSIS AND REDESIGN OF A STEAM TRAP
by Jonathan Hubbard, Rachelle Reichert, and Joel Virgin
Sponsor: Mr. Charles Reynolds, Armstrong International Incorporated
Faculty Advisor: Muralidhar Ghantasala
2:00p.m. to 2:25p.m., D-204/205

Specific design parameters to determine the real time relationships and characteristics of a steam trap were evaluated. To operate at safe conditions, steam traps must be able to meet the American Society of Mechanical Engineer's (ASME) Boiler and Pressure Vessel Code (BPVC). Finite Element Analysis (FEA) was carried out on design parameters while the real time evaluation was preformed, emphasizing temperature, pressure, and strain measurements in a LabVIEW Data Acquisition system. A complete analysis of the existing system was provided and recommendations were made on necessary modifications to make the design more efficient, while complying with all the necessary standards.

HIGH FLOW RATE WATER DELIVERY SYSTEM
by Benjamin Greve, Alex Hobart, and Mark Volz
Sponsor: Stephen Kalchik, Kalchik Farms
Faculty Advisor: Christopher Cho
2:30p.m. to 2:55p.m., D-204/205

During harvest, cherries are stored in tanks of water to keep them cool and to prevent the cherries from being damaged. These tanks are moved by forklifts and manually filled with water from a nozzle, a process which is time consuming and requires two people. A fully automated portable system was designed using solid modeling (Solid Works) and fluid flow analysis software (Fluent) and built to allow rapid filling of the empty tank from a holding tank. The system allows the operator to fill the tank in a fraction of the time and also eliminates the need for a second operator.

MECHANICAL AND AERONAUTICAL ENGINEERING - B
Session Chair – Parviz Merati
Room C-124

BUOYANCY DRIVEN FLOW IN AN AUTOMOTIVE UNDERHOOD
by Charles Gauthier, Kevin Kalchik, Robert Messner, and Thomas Spencer
Sponsors: General Motors: Simulation Global Process Center
Denso North America Foundation
Faculty Advisor: Parviz Merati
9:00a.m. to 9:25a.m., C-124

Thermal soak conditions can degrade engine components in a vehicle which shortens its life. These conditions were studied by using a simplified full scale model to simulate the buoyancy driven air flow in an automotive underhood compartment. Stereo Particle Image Velocimetry (SPIV) was used to obtain the vector flow field results of one plane. Results were analyzed using DaVis software. Multiple aspects of the experimental setup were designed in Pro/ENGINEER and then fabricated for flexible and repeated use. The results will verify computational results and help in the design of future automotive products.

SAE SUPERMILEAGE VEHICLE DESIGN
by Kenneth Conn, David Nielsen, and Matthew Schmandt
Faculty Advisor: Tianshu Liu
9:30a.m. to 9:55a.m., C-124

A small light weight single passenger vehicle was designed and built to achieve the highest possible energy efficiency. The vehicle's fiberglass body is built around a space frame which was designed using solid modeling software. Finite Element Analysis was used to assure structural integrity while Computational Fluid Dynamics was used to optimize the aerodynamics of the body shell. The vehicle is powered by a single cylinder engine and is equipped with bicycle tires to help reduce rolling resistance.

MIDGET CAR CHASSIS DESIGN
by Nick Deevers, Christopher Gray, and Tyler Yonker
Sponsor: Lou Cicconi, Cicconi Racing
Faculty Advisor: Richard Hathaway
10:00a.m. to 10:25a.m., C-124

The USAC Midget is a race car designed for racing on small oval tracks at high speeds, subjecting the car to large accelerations. To perform better under those conditions a new chassis and suspension system has been designed which lowered the center of gravity, widened the spring base, and increased the torsional stiffness of the car. By applying sound vehicle dynamic engineering principles and through the use of simulation software the best possible solutions have been obtained which should allow the designed vehicle to outperform the competition.

THERMOELECTRIC WASTE HEAT RECOVERY
by Cameron Hibiske, Roy Everett Holmberg III, and Joshua Steen
Faculty Advisor: Ho Sung Lee
10:30a.m. to 10:55a.m., C-124

Increasing costs of fossil fuels and environmental concerns has led the automotive industry to research ways to improve fuel economy. A thermoelectric waste heat recovery system was designed to convert heat rejected to exhaust gas into electrical energy, while minimizing the increase in exhaust gas pressure. Optimization equations were developed to design a system of heat transfer which was modeled in 3D and analyzed using CFD. A prototype has been constructed and tested for power output and efficiency.

DESIGN OF A SOLAR THERMAL SYSTEM
by Ehab Osman, Jonathan Singer, and Eric Snell
Faculty Advisor: Ho Sung Lee
11:00a.m. to 11:25a.m., C-124

Solar thermal systems are devices that are designed to heat water for residential or commercial applications by the utilization of solar energy. Due to rising electricity costs and environmental consciousness in the past few decades, the use of solar powered systems have become more appealing to residential, commercial, and government developers as a means to reduce energy costs. A solar thermal system was designed and built to provide a working model for demonstration and educational use. The design of the system incorporates some key factors such as quality, cost, energy efficiency, portability, life span and environmental pollution.

DESIGN OF FABRICATED STEER AXLE BEAM FOR COMMERCIAL VEHICLES
by Anthony Provenzano and Brian Westmoreland
Sponsors: Dana Corporation, Commercial Vehicle Systems Division
Steve Byrne, Steer Axle Group, Dana
Stoyan Stoychev, Steer Axle Group, Dana
Faculty Advisor: Judah Ari-Gur
11:30a.m. to 11:55a.m., C-124

Commercial vehicle steer axles typically consist of a solid forged steel beam. Although forging provides exceptional strength and fatigue life characteristics, it requires costly tooling. Manufacturing costs are further augmented by a decreasing number of facilities that can accommodate the complex forging process. A formed beam consisting of multiple pieces welded together was designed to reduce cost. Pro/ENGINEER was utilized to design the axle while ANSYS Workbench was used to analyze stress distribution and stiffness characteristics. The proposed design is a less expensive alternative for commercial steer axles that meets all existing performance requirements.

MECHANICAL AND AERONAUTICAL ENGINEERING - C
Session Chair – Kapseong Ro
Room D-212

VISION BASED ROLL STABILIZATION OF AN UNMANNED AERIAL VEHICLE
by Karl Madon
Faculty Advisor: Kapseong Ro
9:00a.m. to 9:25a.m., D-212

The cooperative control of multiple small Unmanned Aerial Vehicles (UAVs) has attracted great attention for potential military and civil applications. One of the current research issues for cooperative UAV control is the autonomous see-and-avoid (SEAD) operational capability, which heavily depends on intelligent interpretation and decision process from vision/image based sensors. An algorithm was developed to extract aircraft bank angle from on-board forward-looking video camera images using commercial image processing software, and a wing-leveler autopilot was designed for a camera mounted small UAV using the estimated bank angle.

ADVANCED DESIGN WIND TUNNEL CONTROL AND DATA ACQUISITION
by Myles Cooley and Kelly Ohrtman
Faculty Advisor: Tianshu Liu
9:30a.m. to 9:55a.m., D-212

Computers and software become obsolete daily, requiring constant updates. A new LabVIEW 8.2 program was designed to replace the existing, outdated program used to run an Advanced Design wind tunnel. This program is used to control the wind tunnel's airspeed and acquire and display values for lift, drag, side force, moment, and pressure. This program was designed for simplicity and ease of use, and will save valuable time when running tests in the wind tunnel.

PROPELLER THRUST EFFICIENCY ANALYSIS AND TEST BENCH DESIGN
by Derek Albrecht, Christopher Deatrick, Mini Mathew, and Renee Mifsud
Sponsor: Parker Hannifin Corporation
Faculty Advisor: Kapseong Ro
10:00a.m. to 10:25a.m., D-212

The testing and analysis of fixed pitch propeller used for most UAVs is necessary for the optimization of propeller speed and airspeed to maximize aircraft performance. Additionally, Aeronautical Engineering students need hands on exposure to propeller thrust efficiency experimentation. A test bench was designed and constructed using instrumentation to measure torque and thrust in addition to power input to the motor. Labview was used to acquire and organize the data coupled with theoretical blade element analysis results generated by Matlab. The test bench will allow experimental analysis of a wide range of small diameter propellers and their constituent DC motors.

DUCTED FAN PROPULSION
by James Frank and Brian Norris
Faculty Advisor: William Liou
10:30a.m. to 10:55a.m., D-212

A large neutral buoyancy airship, intended for cargo transportation, requires a propulsion system capable of efficiently sustaining cruise speed and properly controlling the aircraft in all flight situations. Ducted fans have advantageous qualities at speeds the airship is estimated to achieve, so they are the basis upon which the propulsion system has been designed. A model of the ducted fan propulsion system was developed in ADAMS/View dynamic simulation software. With the model, predictions about airship controllability and performance can be made. Dynamic analysis of the propulsion system is an essential tool, guiding further development towards an optimized final design of a ducted fan propulsion system for a cargo lifting airship.

JOINED WING LIGHT SPORT AIRCRAFT DESIGN
by Erica Dudley and Andrew Prine
Faculty Advisor: Dennis Vandenbrink
11:00a.m. to 11:25a.m., D-212

The joined wing configuration offers a design that eliminates the need for a heavy cantilever beam, thereby reducing the overall weight of the structure while producing ample lift. This design is especially revolutionary for application to light sport aircraft which has a maximum weight limit of 1,320 lbs. Using finite element analysis in conjunction with solid modeling software, a light sport aircraft was designed with the intention of minimizing weight.

ULTRALIGHT AIRCRAFT DESIGN AND CONSTRUCTION
by James Cahill, Jon Gesek, Jeff Muehl, and Josh Racine
Faculty Advisor: Judah Ari-Gur
11:30a.m. to 11:55a.m., D-212

Recently the market for high-performance ultralight aircraft has decreased dramatically. This is due to the heavy materials and overly-robust designs required for high-performance flight. Using light-weight, high-strength materials such as carbon-fiber composites, a 28 horsepower, single seat ultralight was designed, lofted, and constructed to meet the FAA Federal Aviation Regulations Part 103 requirements. The aircraft was proven to be structurally sound and airworthy using 3D modeling programs, finite element analysis programs, and computational fluid dynamics programs.

TURBULENT FLOW TURBINE DESIGN
by Jaivi-John George, Ross Wetzel, and Troy Yakel
Faculty Advisor: Tianshu Liu
1:00p.m. to 1:25p.m., D-212

The recent increase in awareness of environmental pollution has brought with it a great interest in developing new ideas for nonpolluting electrical energy generation. A concept was developed to capture the energy present in the aerodynamic wake of a passing motor vehicle. This was accomplished by placing a stationary wind turbine in the path of the moving air from the passing vehicle's aerodynamic wake. Comparing the information from both computational fluid dynamics simulations and model testing, optimal placement of the turbine was determined for maximum energy generation. A full scale computational model was designed using Solid Works modeling software. Although this concept is not a complete energy solution, it could be a valuable part of advancing environmentally friendly energy alternatives.

ASME Central Michigan Section proudly announces
An award for the best senior engineering design project for
Mechanical and Aeronautical engineering students for Spring 2008.

This award includes a $100 check and merit certificate.

ASME advocates quality and innovation in Mechanical Engineering education and provides resources, support, and recognition of excellence among engineering students.

PAPER ENGINEERING, CHEMICAL ENGINEERING, AND IMAGING
Session Chair – Peter Parker
Room D-208

EFFECT OF LINE ANGLE ON CONDUCTIVITY OF GRAVURE PRINTED ELECTRONICS
by Garrett Tucker
Faculty Advisor: Alexandra Pekarovicova
10:00a.m. to 10:25a.m., D-208

The increased interest in the printing of electronic components creates the need to better understand the directionality, or effect, of the line angle on its conductivity. Lines were gravure printed at multiple angles, using water based and solvent based silver inks at two resolutions, to determine the effect of line angle on its conductivity. The data obtained from these measurements was used to acquire a greater understanding of the relationship between line orientation and its print quality and ultimately its conductivity.

LOW COST FIBER ALTERNATIVE
by Kara Adzima, Robert Bethke, Mark Ostroski, and Brian Stone
Sponsor: Abbie Rodriguez, Graphic Packaging International
Faculty Advisor: Andrew Kline
10:30a.m. to 10:55a.m., D-208

With rising fiber costs there is a need to find lower-cost fiber sources. An alternative has traditionally been ignored due to the difficulty in repulping it. This alternative has resin sizing and wet strength additive which makes it difficult for water to penetrate, but has good strength properties and can be obtained at a lower cost. Recommendations were made for adjustments to the current pulping operations to accommodate the use of the new fiber source, while using the least amount of energy and residence time. An economic analysis was performed to determine the preferred design and to rank order recommendations.

COOLING TUNNEL OPTIMIZATION
by Christopher Dunsmore, Michael Folck, Trisha Janicki, and Jason Thomas
Sponsor: Terry Andren and Mark Bergman, Kellogg Company
Faculty Advisor: Andrew Kline
11:00a.m. to 11:25a.m., D-208

Multiple types of granola or snack bars are produced with various cereal coating and binder properties, but all are cooled using similar unit operations. These cooling tunnels are made by different equipment vendors. Comparison and evaluation of various types of cooling tunnels from different vendors was done using existing facilities. An economic analysis was performed to identify an optimal cooling solution from both energy and operations perspectives for manufacturing multiple types of bars on the same cooling tunnel line.

ENERGY LOSSES IN INDUSTRIAL BAKING OVENS
by Steven Eick, Paul Fiero, Sarah Fullerton, and Brian Naiman
Sponsor: John Guy and David Drum, Kellogg Company
Faculty Advisor: Andrew Kline
11:30a.m. to 11:55a.m., D-208

The baking industry operates large gas-fired tunnel ovens to bake their various products. Not all of the heat supplied is effectively used to convert raw dough into baked food. As energy costs have risen the sources and causes of energy wastage from the ovens have become a significant concern. Through the analysis of the ovens a computer model was produced to determine where heat losses occur. These losses have been identified so that energy saving, and therefore cost savings, procedures can be put into place. An economic analysis to optimize and compare cost savings was performed.

MELENGESTROL ACETATE PROCESS IMPROVEMENT
by Geoffrey Bolak, Brock Brockway, and Tim Freehling
Sponsor: Crystal Sattler, Pfizer, Inc.
Faculty Advisor: Andrew Kline
1:00p.m. to 1:25p.m., D-208

The process currently employed to manufacture melengestrol acetate involves historically difficult intermediate production steps. Each of these steps requires product isolation, which reduces the overall product yield. As a result, a process has been developed to manufacture melengestrol acetate without the intermediate isolation steps. A design and cost estimate were developed to implement the new process.

CLOSED LOOP COOLING SYSTEM FOR FERMENTATION TANKS
by Dustin Moseley, Nathan Tate, Jason Waterstradt, and David Williams
Sponsor: Laura Berry, Pfizer, Inc.
Faculty Advisor: Andrew Kline
1:30p.m. to 1:55p.m., D-208

Biological fermentation processes are utilized to produce many of the active ingredients used in the production of pharmaceutical products. Several process steps generate heat, which needs to be removed from the system. A closed-loop cooling system and its computer model were designed for cooling large capacity fermentation vessels. This system was created with the goal of being capable of containing leaks which may occur during the fermentation process. Initial capital costs and operating costs were optimized through the design. The completed system provides an example which could be applied to similar processes within the company.

DISPLACEMENT DISTILLATION OPTIMIZATION
by Jeffrey Harms, Daniel Powell, and Karen Simmons
Sponsor: Ryan VanAuker, Pfizer, Inc.
Faculty Advisor: Andrew Kline
2:00p.m. to 2:25p.m., D-208

There is a need for a constant volume batch distillation to reduce energy and solvent loss. Computer software was used to model distillation as a batch process. This modeling allowed for the analysis of implementing the constant volume method as well as determining any improvements in energy consumption. Needed capital investment was calculated, as well as overall cost savings and measures of profitability.

ENERGY TRACKING AND CONTROL
by Kevin Frees, Hans Olaf Peterson, and Marc Yowell
Sponsor: Mark Lummis and Ian Beaton, Pfizer, Inc.
Faculty Advisor: Andrew Kline
2:30p.m. to 2:55p.m., D-208

Analysis of energy usage and its control was done to minimize utility costs. Statistical analysis of ambient environmental conditions allows prediction of utility requirements. Using CUSUM, a statistical analysis method, a mathematical model was created to predict energy demand for a pharmaceutical process. The model incorporates over five years of environmental conditions that impact particular buildings' utility loads, and one year of utility usage data for the particular building. Future use of the model will allow personnel to more accurately assess the results to be used in energy savings projects, improving energy control, and it could provide early failure detection.

The College of Engineering and Applied Sciences offers a wide variety of programs:

Civil and Construction Engineering (269) 276-3210

- Civil Engineering
- Construction Engineering

Computer Science (269) 276-3101

- Computer Science – Theory and Analysis
- Computer Science - General option

Electrical and Computer Engineering (269) 276-3150

- Computer Engineering
- Electrical Engineering

Industrial and Manufacturing Engineering (269) 276-3350

- Engineering Graphics and Design Technology
- Engineering Management Technology
- Industrial and Entrepreneurial Engineering
- Manufacturing Engineering Technology

Manufacturing Engineering (269) 276-3253 (Muskegon, Battle Creek, Southwest Benton Harbor, and Lansing)

Mechanical and Aeronautical Engineering (269) 276-3420

- Aeronautical Engineering
- Mechanical Engineering

Paper Engineering, Chemical Engineering, and Imaging (269) 276-3500

- Chemical Engineering
- Paper Engineering
- Paper Science
- Imaging

College of Engineering and Applied Sciences Advising Office (269) 276-3270

The **Master of Science in Engineering** is offered in computer, electrical, mechanical, and industrial engineering. The **Master of Science** is offered in computer science, construction engineering, engineering management, manufacturing engineering, operations research, and paper and imaging science and engineering. The **Ph.D.** is offered in computer science, electrical and computer engineering, industrial engineering, mechanical engineering, and paper and imaging science and engineering.

Information about the College of Engineering and Applied Sciences at Western Michigan University

CEAS Mission

To educate our learning community for life-long excellence in responsible professional leadership. To increase knowledge through collaborative discovery, integration, application, and teaching. To serve as a resource and partner to our constituents. To prepare job-ready graduates for the global market.

CEAS Vision

A scholarly community dedicated to excellence through student-centered education and research emphasizing professional practices in engineering and applied sciences.

CEAS Four Cornerstones

- Engagement: Produce job ready graduates with the ability to grow in their profession and are life long learners
- Innovation: Move the profession and society forward by providing engineers, scientists, and technologists with new capabilities
- Leadership: To graduate engineers, technologists, and applied scientists who are and will continue to be leaders in their profession and community
- Globalization: Our graduates must be prepared to work in a global engineering and applied sciences industry

CEAS Administration

- Dean: Dr. Timothy J. Greene
- Associate Dean of Undergraduate Studies: Dr. Edmund Tsang
- Associate Dean of Graduate Studies: Dr. Osama Abudayyeh
- Chair of Civil and Construction Engineering: Dr. Haluk Aktan
- Chair of Computer Science: Dr. Don Nelson
- Chair of Electrical and Computer Engineering: Dr. John Gesink
- Chair of Industrial and Manufacturing Engineering: Dr. Paul Engelmann
- Chair of Manufacturing Engineering: Dr. John Patten
- Chair of Mechanical and Aeronautical Engineering: Dr. Parviz Merati
- Chair of Paper Engineering, Chemical Engineering, and Imaging: Dr. Said AbuBakr

CEAS Data (Fall 2007)

- Bachelor's Enrollment: 1995
- Master's Enrollment: 316
- Ph.D. Enrollment: 59
- Number of Faculty: 89
- Number of Staff: 28

CEAS Contact Information

- CEAS Advising Office: (269) 276-3270
- CEAS Dean's Office: (269) 276-3253
- CEAS Student Outreach and Recruitment Coordinator – (269) 276-3272
- CEAS Cooperative Education and Internships: Fred Sitkins – (269) 276-3261
- CEAS Website: www.wmich.edu/engineer