11-2000

27th Conference on Senior Engineering Design Projects

College of Engineering and Applied Sciences

Senior Design Project

The 27th Conference on Senior Engineering Design Projects

You are invited to attend the twenty-seventh Conference on Senior Engineering Design Projects. The conference will be held from 9 a.m. to 2:30 p.m. **Tuesday, November 28**, at the Bernhard Center on the 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 circular drive in front of the Bernhard Center and then park in the lot in front of Hoekje Hall.
(See map - take North Dormitory Road. Hoekje is #65 on the 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 second floor of the Bernhard Center. Sign-in sheets will be mailed to teachers the day after the conference.

Parking is available in the ramp near the Bernhard Center. Please park in metered spaces. There is a charge for parking. Meters accept quarters only.

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

Session locations, starting times for project descriptions:

Electrical and Computer Engineering	210	9:00 to 2:30
Industrial and Manufacturing Engineering	209	9:00 to 2:30
Materials Engineering	242	9:00 to 2:30
Mechanical Engineering and Aeronautical Engineering A-I	211	9:00 to 2:30
Mechanical Engineering and Aeronautical Engineering B-I	212	9:00 to 2:30
Paper Science and Engineering	208	9:00 to 2:30

Refreshments will be available in the lobby from 8:30 a.m. to 10:30 a.m.

A **lunch** break is scheduled from noon to 1 p.m.

For more information about the conference, call Cathy Smith at (616) 387-4017.

The 27th Conference on Senior Engineering Design Projects

CE = Construction Engineering
ECE = Electrical and Computer Engineering
ID = Industrial Design
IME = Industrial and Manufacturing Engineering
MAE = Mechanical and Aeronautical Engineering
PSE = Paper Science and Engineering
FL = Faculty Lounge

Time	Room	Dept.	Topic
9:00AM	242	CE	Design of a Project Management System for a Companys Headquaters
	212	ECE	Induction Furnace Temperature Control
	213	ID	Computer Game Controller
	208	IME A-I	Design and Fabrication of a Rolling Test Bench for a Series Hybrid Electric Vehicle
	212	IME B-I	Process Improvement and Marketing Development at a Nonprofit Manufacturing and Processing Facility
	210	MAE A-I	Stealth Washer
	211	MAE B-I	Temperature Conditioning System
	FL	PSE	Analysis of Crepe Blade Vibration
9:30AM	242	CE	Comprehensive Logistics Phase I
	212	ECE	Memory Chip Emulator for Surgical Power Tools
	213	ID	Femoral Nerve Disorder Leg Brace
	208	IME A-I	Optimizing the Electrical System for a Series Hybrid Electric Vehicle
	209	IME B-I	Redesign of a Purchasing System to Comply with ISO 9000:2000
	210	MAE A-I	Design Optimization of Amtryke™ (The Therapeutic Tricycle)
	211	MAE B-I	Hydrodynamic Running Show Cushioning System
	FL	PSE	Reducing Decomposition Time in Landfills by an Aerobic Process
10:00AM	242	CE	
	212	ECE	
	213	ID	
	208	IME A-I	
	209	IME B-I	
	210	MAE A-I	
	211	MAE B-I	
	FL	PSE	

	242	CE	
10:30AM			
	212	ECE	
	213	ID	
	208	IME A-I	
	209	IME B-I	
	210	MAE A-I	
	211	MAE B-I	
	FL	PSE	
11:00AM	242	CE	
	212	ECE	
	213	ID	
	208	IME A-I	
	209	IME B-I	
	210	MAE A-I	
	211	MAE B-I	
	FL	PSE	
11:30AM	242	CE	An Active Jam Detector for a High-Speed Web Press
	212	ECE	Enhanced Instructional Material for Computer-Aided Design Systems
	213	ID	Analysis of Helix Screw Conveyor System
	208	IME A-I	Pick and Place Loader for Brass Fittings
	209	IME B-I	Lignosulfonate as a Strength Additive for Non-Wood Paperboard
	210	MAE A-I	
	211	MAE B-I	
	FL	PSE	
1:00PM	213	ECE	Short-Range Height Measurement Device
	208	IME	Study of Operating Room Turnover Time
	209	MAE A-I	Integration of Vibration System and Environmental Testing Chamber
	210	PSE	Retention of Nitrogen and Phosphorous Using Compost
	211		
1:30PM	213	ECE	Circuit Tester for Self-Dimming Welding Helmet
	208	IME	Optimization of Aluminum Extrusion Operation
	209	MAE A-I	Altering Surface Characteristics to Disrupt Flow

	210	PSE	Utilization of Clarifier Sludge for Mushroom Cultivation
	211		
2:00PM	213	ECE	Anti-Collision System for Cooper Car
	208	MAE A-I	Clamp Force of a Heavy Truck Axle Power Divider Unit
	210		
	211		

The College of Engineering and Applied Sciences is grateful to these sponsors which have provided or cooperated in Senior Engineering Design Projects being presented in November 2000. If you have a project for our students or if you would like more information, please call Dace Copeland at (616) 387-4017.

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The 27th Conference on Senior Engineering Design Projects

ELECTRICAL AND COMPUTER ENGINEERING

Session Chair - John Gesink
Room 210

UNIVERSAL PUMP TEST STAND

by Fuk Hong Au, Shawn Mandeville and Raymond Waters
Sponsor: Kevin Doyle - Parker Hannifin ABX/NWL Aerospace Division
Faculty Advisor: Dean Johnson
9:00 a.m. to 9:25 a.m., Room 210

A Universal Pump Test Stand was designed and built to better meet the need for real time data acquisition. Knowing this, circuits were designed to allow real time data acquisition from transducers connected to different pumps. Software was then written and downloaded into a computer to interface with the pump stand signal conditioning unit, designed circuits, and the test stand operators. The software also allowed for various types of data storage. The computer, pump stand signal conditioning unit, and the circuits were then placed into the test stand cabinet to allow easy connection between each other and allow for future wiring if needed.

AUTONOMOUS MICROCONTROLLED ROBOT

by Phuc Tan Cao, Ter Chong Wang and Kimberly Wynne
Faculty Advisor: Frank L. Severance
9:30 a.m. to 9:55 a.m., Room 210

An autonomous, microcontrolled robot was designed and built to provide a working prototype for a proposed freshman robotics course. Autonomy was achieved by interfacing infrared circuitry with a microcontroller. Nitinol wire, which contracts when heated, was used for propulsion. An infrared receiver located on the robot's body translates commands sent from a handheld infrared transmitter. The microcontroller was programmed to decode signals from the receiver, determine which command should be executed, and coordinate the contraction of the nitinol wires. A user enters a sequence of commands into the transmitter to move the robot on a desired trajectory.

GENTEX MIRROR TEST UNIT

by Chris Adamski, Sally Burg and Suhel Daud
Sponsor: Michael Door - Gentex Corporation
Faculty Advisor: Ikhlas Abdel-Qader
10:00 a.m. to 10:25 a.m., Room 210

An engineering corporation was interested in improving the quality assurance of their exported automatic-dimming rearview mirror system. Their current system had no provision for checking loose or broken parts of the mirrors that were shipped. A test unit was designed and developed, using LabVIEW and analog circuit technology to detect vibration noises in the mirror system. The vibration noises signified loose parts or broken pieces of plastic, and the program then warned the worker of a defective mirror system.

RADIO FREQUENCY IDENTIFICATION

by Cindy Gan, Terence Lai and David Zielesch
Sponsor: William Odisho and Daniel Coleman - Dana Corporation
Faculty Advisor: Raghvendra Gejji
10:30 a.m. to 10:55 a.m., Room 210

A radio frequency (RF) system was designed to read and write axle and brake identification data. Identification data is coded in a microchip (tag) attached to the axle or brake. The reading system interrogates the tag with RF. The hardware designed consisted of building an antenna and then tuning it for best results. Software was written using Visual Basic to interface the Reader/Writer to a PC. Testing was done on the tags to determine durability and the best method of mounting.

MICROCONTROLLER-BASED COIL WINDER
by Derek Durkee, Ryan Eavey and Chin Guan Tey
Sponsor: Greg Rabick - Stryker Instruments
Faculty Advisor: Joseph A. Kelemen
11:00 a.m. to 11:25 a.m., Room 210

A microcontroller-based, electric motor driven coil winder was designed and built. The system allows a user to enter the required number of coil turns and the desired motor speed. The operator may use a keypad to change the motor speed during the winding operation. The system used the operator specified speed and the measured speed to control the motor through pulse width modulation. An LCD display allows the user to view the actual motor speed, turns completed, turns remaining, and turns specified. The system stops when the specified number of turns is reached which completes the coil winding.

AN ACTIVE JAM DETECTOR FOR A HIGH-SPEED WEB PRESS
by Travis Bailey, Michael Pyne and Dave Willis
Sponsor: Ronald Kelley - Graphic Packaging Corporation
Faculty Advisor: Bradley Bazuin
11:30 a.m. to 11:55 a.m., Room 210

Product monitoring and tracking during the manufacturing cycle is essential. This is particularly vital in the folding carton industry where production speeds can reach up to 45 cartons per second. Faster, more reliable jam detection must be incorporated to reduce downtime and costly repairs of machines. At a local company, the yearly cost attributed to carton die cutting jams is approaching $250,000. The Active Jam Detector (AJD) significantly reduces these problems by continuously monitoring carton production. Comparing the current cycle time to previous averaged values, it will determine if a jam has occurred. Upon jam detection, the press is rapidly stopped. It is estimated that $60,000 will be saved with the installation of the Active Jam Detector.

SHORT-RANGE HEIGHT MEASUREMENT DEVICE
by Matthew Owen, Meenachi Raja Manickam and Ben Standish
Sponsor: Sweet Manufacturing Inc.
Faculty Advisor: Richard Hathaway
1:00 p.m. to 1:25 p.m., Room 210

For many years, racecar teams have been fine-tuning their suspension systems by using a conventional ruler method. The suspension height is measured from the ground to reference points on the racecar's frame. The ruler technique is not accurate enough to measure the small adjustments in the suspension geometry that affect the performance of the racecar. Therefore, a rugged, self-powered short-range height measurement device was designed and built to replace the ruler technique. The device uses a microcontroller, which stores the measured values and a sensor to measure and display, in real-time, distances of 1î - 5î with an accuracy of 0.060î.

CIRCUIT TESTER FOR SELF-DIMMING WELDING HELMET
by Brent Bedau, Hooi Chin Cha and Jeffrey D. Frey, Jr.
Sponsors: Jim Thompson and Andy Talbott - SAFARI Technologies, Inc.
Faculty Advisor: Janos Grantner
1:30 p.m. to 1:55 p.m., Room 210

The benefactor of this project produces circuit boards for welding helmet visors that automatically darken to protect an operator's eyes. Currently, a DOS based computer is used to test the circuit components. To update the system with current technology and to minimize space on the production floor, a new test system has been developed. This new system incorporates a Microchip PIC microcontroller, a numeric keypad and a LCD display that show the results of the tests run on the circuit board. It is capable of reading 20 analog voltage inputs and comparing each to acceptable values stored in the microcontroller.

ANTI-COLLISION SYSTEM FOR COOPER CAR
by Paul Brehob, Yong Kok Yu and Thuan Nguyen
Faculty Advisor: Damon Miller
2:00 p.m. to 2:25 p.m., Room 210

The Cooper Car is a vehicle used to transport children with severe trunk motor-skill deficiencies. This modified toy car used two electrical motors to drive two independent sets of wheels. This enables motion in any direction. The car controls are designed to allow a disable child to operate it. Many disable children tend to be collision prone; thus, an ultrasonic anti-collision was built for this car. This system generates ultrasonic signals and detects their echoes to sense obstacles. When an obstacle is detected, the car motors are turned off.

INDUSTRIAL AND MANUFACTURING ENGINEERING

Session Chair - John Gesink
Room 209

PART-TO-CAD REVERSE ENGINEERING
by Chad Brackenridge, Michele LeClair and Robert Smalldon
Faculty Advisor: Jorge Rodriguez
9:00 a.m. to 9:25 a.m., Room 209

Part-to-CAD Reverse Engineering (PCRE) is the ability to digitize a part and transfer the data to computer aided design (CAD) software. PCRE is commonly used in industry today because of the lack of computer models for parts and the inability to access existing files. The objective of this project was to establish a well-defined methodology for performing PCRE, which includes the capability to effectively transfer CAD models to various CAD packages at Western Michigan University. The outcome of this project is a set of guidelines that were generated and tested in order to define how PCRE can be performed in instructional labs.

REDESIGN OF A MANUAL MATERIAL HANDLING STATION
by Russell Schaffer, Joseph Seestadt and Luis Zambrano
Faculty Advisor: Tycho Fredericks
9:30 a.m. to 9:55 a.m., Room 209

A manual material handling station at a manufacturing facility has adhesive issues with their product that

led to productivity and safety concerns. Studies were conducted to determine machine breakdown rates, amount of scrap and the percentage of cartons with adhesive issues. A simulation model was constructed and alternatives were evaluated. Recommendations were made that would increase the productivity of the station while reducing the risk of injuries with the repackaging line where cereal variety packs are assembled.

AUTOMATIC LASH ADJUSTMENT FOR A HEAVY-DUTY DIESEL
by Damon Blumenstein, Andrw Collins and Jeremy Lipton
Sponsor: Doug Nielson - Eaton Corporation
Faculty Advisors: Jorge Rodriguez and James VanDePolder
10:00 a.m. to 10:25 a.m., Room 209

Heavy-duty diesel engines used in hauling operations require periodic valve adjustments. Modern gasoline engines use automatic adjusters. If a heavy-duty diesel is removed from service for adjustments it requires time, parts and also down time for the accompanying vehicle. Sometimes the maintenance will be ignored all together due to the cost of the down time. The project also incorporates the use of the engine's cylinder compression as a retarder (brake) to slow the vehicle. The braking action interferes with the normal valve operation. This project allows for automatic adjustment of the valve and being able to utilize an engine brake, which will eliminate the need for down time of the vehicle to make the adjustments.

THERMAL DISTORTION OF CHEMICALLY BONDED SANDS
by Karieem Allen, Jung Lee and Chassidy Walker
Faculty Advisor: Sam Ramrattan
10:30 a.m. to 10:55 a.m., Room 209

The group performed thermal distortion tests using different chemically bonded sand disc specimens at the elevated temperature of 2,200 degrees F. The thermal distortion tester was modified due to the fact that the previous machine could only achieve temperatures up to 1400 degrees F. In addition to the thermal distortion test, the group performed three other tests at room temperature. These were transverse strength test, scratch hardness test and permeability test. The interesting findings were that different thermal distortion curves are generated from changes in the thermal mechanical and thermal chemical properties of the disc specimens. The results can be used in the foundry industry to produce near-net-shaped castings.

DESIGNING A PURCHASING INFORMATION SYSTEM TO COMPLY WITH ISO-9000:2000
by Owen Carter, Stephanie Means and Robert Meredith
Sponsors: Walt Ruszkowski, Randy Lettow and Kevin Tavernier - Ronningen-Petter
Faculty Advisor: David Lyth
11:00 a.m. to 11:25 a.m., Room 209

The purchasing information system at an ISO-9000 registered manufacturer of filtering systems for the processing industry had a communication gap between quality control, purchasing and their corrective and preventive action system. This senior design team collected data to analyze their current supplier performance while identifying and documenting problems with their current supply base management practices. This allowed the team to use different techniques to redesign and close the loop in their system while meeting the requirements of ISO-9000:2000.

ENHANCED INSTRUCTIONAL MATERIAL FOR COMPUTER-AIDED DESIGN SYSTEMS
by Scott Gibson, Donald R. Park, Jr. and Brad Przysiecki
Faculty Advisors: Jorge Rodriguez and Murari Shah
11:30 a.m. to 11:55 a.m., Room 209

Currently there are limited teaching materials available to help students learn the latest versions of integrated CAD softwares Pro/ENGINEER, CATIA and I-DEAS. The goal of this project was to develop industry-based and user-friendly documentation for learning these softwares. This was accomplished by creating a set of tutorials that teach basic CAD modeling, assembly and documentation. The set of tutorials are divided into seven lessons that could be taught over the course of half a semester. Lastly, the tutorials were tested and updated based on participant's feedback.

STUDY OF OPERATING ROOM TURNOVER TIME
by Alex Lorenz, Sarah Pohl and Arief Wismansyah
Faculty Advisor: Larry Mallak
1:00 p.m. to 1:25 p.m., Room 209

A southwest Michigan hospital suffered from the same national trends now affecting hospitals across the nation, such as rising labor costs, managed care pressures and increasing competition. It was under these conditions that this hospital determined operating room turnover time was an area for improvement. In addition to traditional engineering tools, group problem solving techniques with pertinent hospital staff were used to determine the scope of the project. The result of the analysis led to a focus on the areas of delay analysis, equipment usage and turnover team concept.

OPTIMIZATION OF ALUMINUM EXTRUSION OPERATION
by Jon Hurry, Phillip Lim, Paul Lughermo and Yuvaraga Pachiaper
Sponsor: Jason Barnes, Tim Bartels and Jim Busch - Bowers Manufacturing Company
Faculty Advisor: Fred Sitkins
1:30 p.m. to 1:55 p.m., Room 209

Our team evaluated three different processing techniques which are used for the control of productivity and quality in an aluminum extrusion operation. We identified the processing technique which best suited our sponsors balanced need for quality and productivity. Once a process was identified our team assisted in locating closed loop control systems which could operate using the processing techniques which we recommended. Working with our sponsor we evaluated two closed loop systems and made purchase recommendations based on the abilities of the equipment to meet the processing needs which we had previously identified.

MATERIALS ENGINEERING

Session Chair - Pnina Ari-Gur
Room 242

INTENSIVE QUENCHING: COST SAVINGS AND IMPROVED MECHANICAL PROPERTIES
by Nathan F. Broker
Sponsors: Dana Corporation
Faculty Advisor: Pnina Ari-Gur
9:00 a.m. to 9:25 a.m., Room 242

Intensively quenched 1547RH Mod output shafts were examined as a possible alternative to standard production 15B41H Mod shafts. The 1547RH Mod steel bar stock that had been intensively quenched was metallurgically investigated. Mechanical testing as well as subsequent metallurgical analysis was performed on output shafts made from a 1547RH Mod steel. The results were compared against data obtained from standard production shafts made from 15B41H Mod steel. The process of intensive quenching as well as its benefits were explained.

MECHANICAL AND AERONAUTICAL ENGINEERING A-I

Session Chair - Jerry Hamelink
Room 211

MX-PRO AMBULANCE STRETCHER ENHANCEMENT PROJECT

by Solomon Townsend and Kevin Vrondran
Faculty Advisor: Jerry Hamelink
9:00 a.m. to 9:25 a.m., Room 211

This enhancement project involved the redesign of a patient transport device used by Emergency Medical Services. Customer needs and service issues were addressed to maintain the position as best in class product and innovation leader. The project focused on four primary design objectives: increased patient weight capacity, increased durability, lighter product weight and improved functionality. The project has gone from concept through prototype iterations, testing, optimization and finally to drawings that will be used in production.

VIBRATORY FINISHING MACHINE: AN ENGINEERING ANALYSIS

by Edwin Weng Hong Cheong and Vinod Menon
Sponsor: Jeremy Hammond - Hammond Roto-Finish
Faculty Advisor: Jerry Hamelink
9:30 a.m. to 9:55 a.m., Room 211

Vibratory finishing machines are used for numerous finishing processes. A new concept was developed to break away from the traditional design. The new design required scrutinizing and testing to determine if it was more efficient. For a better understanding of the machine performance, an engineering approach in statistical analysis was adopted to evaluate the key factors that affected the machine output and performance. The results from the testing yielded optimum machine setup for better machine output and better quality parts.

SYLTHERM XLT RECYCLING UNIT

by Jeremy Hargis and John Hinkle
Faculty Advisor: Jerry Hamelink
10:00 a.m. to 10:25 a.m., Room 211

SYLTHERM XLT is a heat transfer fluid that costs $100 per gallon. Over time, water and metallic particles become entrained in the fluid. The team designed, constructed and optimized a recycling unit that removes the water and metallic particles. The design consists of a two hundred gallon tank, centrifugal pump, heat exchanger and filtration unit. The system allows the user to effectively recycle the usedî SYLTHERM XLT that would otherwise need to be disposed of as waste. Significant cost savings were realized as the disposal and new purchase costs were avoided by the use of the team's design.

LINT SEPARATION DEVICE FOR A CLOTHES DRYER
by Jeanne Chapman and Darin Immink
Sponsor: Terry Anderson - Whirlpool Corporation
Faculty Advisor: Jerry Hamelink
10:30 a.m. to 10:55 a.m., Room 211

An air filtration device was designed to replace the lint screen in a domestic dryer. The new fan scroll design acts as a core separator that removes lint from the air stream. Circular airflow and centrifugal force separate the lint from the dryer exhaust. The lint is then transported to a holding reservoir for future disposal. The reservoir may be used as a lint storage device or further developed as a water flushed system for disposal. A fan scroll prototype was built and optimized using full factorial design.

SHIFT BLOCK DESIGN FOR EUROPEAN AUTOMATIC TRANSMISSIONS
by Ian Perry and Luivi Valero
Sponsor: Thomas Riley - Eaton Corporation
Faculty Advisor: Daniel Kujawski
11:00 a.m. to 11:25 a.m., Room 211

This project involved the conceptualization and design of a new shift block for use in automatic transmissions. The new design allowed for the standardization of the X-Y shifter, an electromechanical component that controls shifting operations on both North American and European shift bar housing mechanisms. The shift block characteristics such as attachment methods, functionality, dimensional schemes and tolerances were designed, analyzed and optimized with Pro Engineer CAD software and ANSYS finite element analysis software. Also, factors such as cost, materials, manufacture-ability and assemble-ability were used to guide the design. The project concluded with the development of a working prototype.

ANALYSIS OF HELIX SCREW CONVEYOR SYSTEM
by Arturo Bonomie and Daryl Prins
Sponsors: Floyd Phalen - Prab Hapman Conveyors
Faculty Advisor: Daniel Kujawski
11:30 a.m. to 11:55 a.m., Room 211

Helical screw conveyor systems are widely used within industry today for conveying different types of media. The media that is being conveyed can range from food consumables to scrap metal. The augers within the helical screw conveyor system were failing due to excessive stress caused by the media. The reason for this failure is lack of proper stress analysis, with relation to the physical properties of the conveyed media. The objective of the project was to establish guidelines and recommendations that will help with the auger selection by analyzing certain relationships between the physical properties of the augers and the media being conveyed. Analysis was done using FEA computer software on the auger, laboratory testing of the auger and media testing of the conveyor system.

INTEGRATION OF VIBRATION SYSTEM AND ENVIRONMENTAL TESTING CHAMBER
by Benjamin Emrick and Hien Nguyen
Sponsor: John Hanse - C. Hanse Industries
Faculty Advisor: Randy Newsome
1:00 p.m. to 1:25 p.m., Room 211

To produce an advanced and diverse environmental chamber a VTC-9 environmental chamber was

equipped with a six degree of freedom vibration system. Magnetic shielding, vibration isolation, thermal shielding, dynamically stressed cooling supply lines and support structures as well as dynamically stressed electrical connections had to be designed into the VTC-9 to equip it with the vibration system. The product of this endeavor is a system that offers never before features of dynamic excitations and control in a proven leader in environmental chambers.

ALTERING SURFACE CHARACTERISTICS TO DISRUPT FLOW
by Kelly Baker and Robert Sinclair III
Faculty Advisor: Randy Newsome
1:30 p.m. to 1:55 p.m., Room 211

Superchargers provide an increased supply of air to an automobile engine for more complete combustion and faster acceleration. Clearances between components in the supercharger are inherent for operation. These clearances result in air leakage, which decrease performance. In an effort to decrease leakage, the flow characteristics within the clearance were altered. This was accomplished by roughing the surfaces along the leakage zones to create disruptions in the airflow, thus discouraging leakage. Test fixtures were designed and constructed to model the air leakage. Experiments were conducted to provide data to support this theory.

CLAMP FORCE OF A HEAVY TRUCK AXLE POWER DIVIDER UNIT
by James C. Brown and Jeremy R. Gordon
Faculty Advisor: Philip Guichelaar
2:00 p.m. to 2:25 p.m., Room 211

Original Equipment Manufactures (OEMs) have been reporting an increasing number of air leakage warranty claims since the implementation of a new Power Divider Unit (PDU) cover. The leakage referred to originates from the interface between the PDU cover and the axle carrier. Initial testing was performed to assess the leakage pattern and to examine surface finishes. The Pro-Engineer software program was used to evaluate the stresses on the cover. It is expected that the changes made will result in a reduction of warranty claims.

MECHANICAL AND AERONAUTICAL ENGINEERING B-I

Session Chair - Koroosh Naghshineh
Room 212

SHOCK PULSE CONTROL FOR A HORIZONTAL IMPACT TESTER OF SHIPPING PACKAGES
by Betsy A. Sundalius and Brian C. Zellers Sponsor: Dan Selvidge - Whirlpool Corporation
Faculty Advisor: Koorosh Naghshineh
9:00 a.m. to 9:25 a.m., Room 212

Products shipped via truck or train endure impact loads that could be damaging. These shock loads created in shipping environments can be mimicked by laboratory shock pulse generating mechanisms attached to an inclined impact tester. The tester dampener characteristics and trip height control the shock duration and acceleration. To establish the relationship between the inclined impact tester characteristics and the shock pulse shape, different adjustable shock dampeners were identified, obtained and tested. By utilizing different shock absorbing mechanisms, the shock pulse can be widely varied to provide shock versatility in the tester.

ANALYSIS OF TWIST IN AN AUTOMOBILE AXLE
by Troy Baker and Charles Moran
Faculty Advisor: Koorosh Naghshineh
9:30 a.m. to 9:55 a.m., Room 212

A local manufacturer builds axles for the Ford Windstar mini-van. In order to simplify vehicle assembly, the twist of the axle must be kept to a minimum. This group has examined the manufacturing process to find ways to reduce twist in the axle. An investigation was conducted to determine which steps in the axle assembly process contribute most to the twist. The measuring device was also examined and corrected to give accurate results. Recommendations include improvements to the manufacturing line to ensure that the axles are manufactured within specifications.

UNIVERSAL CAM PHASER LEAK TEST AND STAND
by Mark Lemieux, Paskell Miller and Ryan Alexander Schramm
Sponsor: Jorge A. Campuzano - Energy & Engine Management Systems
Faculty Advisor: Koorosh Naghshineh
10:00 a.m. to 10:25 a.m., Room 212

A vane cam phaser is a device used to optimize the timing of an engine. It allows the engine's valves to remain open longer of close prematurely to improve fuel efficiency, low-end torque and reduces emissions. Since the cam phaser operates using hydraulic oil pressure, any oil leakage will lead to a decrease in engine performance. To ensure adequate performance, a leak test is conducted on each cam phaser using hot engine oil during manufacturing. This project focuses on accommodating various customer applications through the development of a universal leak test and modified stand that uses a safer ambient temperature test fluid instead of hot engine oil to test cam phasers.

QUARTER MIDGET INDEPENDENT SUSPENSION DESIGN
by Jeremy Haapala, Michael Kroha and Ryan Wharry
Faculty Advisor: Richard Hathaway
10:30 a.m. to 10:55 a.m., Room 212

An independent front suspension was designed to replace the dependent front suspension found on quarter midget racecars. The new suspension improves the performance of the car during handling maneuvers and improves overall speed on the racecourse. The new system was designed with minimal vehicle modifications, while providing complete adjustability and assuring the safety of the driver. Analysis was conducted on the suspension to verify performance under extreme racing conditions.

HYDRODYNAMIC AND PRESSURE FEED OPTIMIZATION FOR A HYDRAULIC PUMP
by Oomer Jiwa and Anthony Montante
Sponsor: Brewce Larkin and John Jones - Parker Hannifin
Faculty Advisor: William Liou
11:00 a.m. to 11:25 a.m., Room 212

A line of variable volume, axial piston pumps for the industrial market are currently in the design phase. A set of hydrodynamic bearings exists within the pumps. These bearings rely on low amounts of friction within the pump components to operate properly. To create this low friction surface, many different possibilities of the bearing and flow path were designed and tested. The group used the test data to choose the optimum design.

PICK AND PLACE LOADER FOR BRASS FITTINGS
by Brian Furlotte, Jeff Lundberg and Matt Schuette
Sponsor: Parker Hannifin Corporation, Brass Products Division
Faculty Advisor: Judah Ari-Gur
11:30 a.m. to 11:55 a.m., Room 212

An automated loader was developed to transfer brass stock into a machining center. Raw parts from a conveyor are orientated utilizing interchangeable tooling plates that allow a pick and place unit to transport them into the machine chucks. Ease of use, accuracy and repeatability were maximized while minimizing maintenance, setup time and cost.

PAPER SCIENCE AND ENGINEERING

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