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Conference On Senior Engineering Design Projects



**Tuesday, April 16, 1991
Bernhard Center**

College of
Engineering and
Applied Sciences

**WESTERN
MICHIGAN
UNIVERSITY**

Conference on Senior Engineering Design Projects

You are invited to attend the eighth Conference on Senior Engineering Design Projects. The conference will be held from 9 a.m. to 3 p.m. Tuesday, April 16, 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 invited 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 at Reid Fieldhouse. School groups traveling in cars are invited to call Linda Hager at (616) 387-4017 to arrange for a parking permit.

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. The sign-in sheets will be mailed to teachers the day after the conference.

Metered **parking** spaces are available in the ramp near the Bernhard Center, in the lot behind the Center, and in the lot to the west of the center, off Michigan Avenue. Meters are checked regularly.

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

Session locations, starting times, and page numbers for project descriptions:

| | | | |
|---|-----------------|-----------|-------|
| Aircraft and Automotive Engineering | 211 | 9 to 1:30 | p. 4 |
| Electrical and Computer Systems Engineering | 210 | 9 to 2:30 | p. 6 |
| Engineering Technology | 209 | 9 to 1:30 | p. 9 |
| Industrial Engineering | 204 | 9 to 1:30 | p. 11 |
| Mechanical Engineering, Session A | Red Rooms A & B | 9 to 2:30 | p. 13 |
| Mechanical Engineering, Session B | 208 | 9 to 3 | p. 15 |
| Paper Science and Engineering, Session A | 213 | 9 to 2 | p. 18 |
| Paper Science and Engineering, Session B | 212 | 9 to 2:30 | p. 21 |

Coffee will be available in room 205 from 8:30 to 10:30.

A lunch break is scheduled from noon to 12:55 p.m. Facilities available in the Bernhard Center include the cafeteria on the first floor, the Brown and Gold Room on the second floor, and, in the lower level, Little Caesar's, Big Boy Express, and Baskin Robbins. Wendy's, Taco Grande, Bilbo's and Maggie's are within about a five-minute drive. Space has been reserved in Red Room C on the first floor for those who wish to have lunch together.

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

AAE = Aircraft and Automotive Engineering
 EE = Electrical Engineering
 ET = Engineering Technology
 IE = Industrial Engineering
 ME = Mechanical Engineering
 PSE = Paper Science and Engineering

| Time | Room | Dept. | Topic |
|-------------|-------------|--------------|--|
| 9 | 211 | AAE | Design of a Measurement System for Vehicle Inertial Parameters |
| | 210 | EE | Electronic Shift Lever Control Unit |
| | 209 | ET | Comparison of 32mm and Face-Frame Construction |
| | 204 | IE | Feasibility of Bar Coding in a University |
| | Red | ME | Analysis of the Pulsed Flow of a Surgical Irrigation System |
| | 208 | ME | Leaf-Baling System |
| | 213 | PSE | Hot-Soft Calendering as a Pre-Treatment |
| | 212 | PSE | Optimum Use of Polymers for Settling of Filamentous Bacteria |
| 9:30 | 211 | AAE | Formula Engine |
| | 210 | EE | Driver Command Console |
| | 209 | ET | Glueability Restoration of Laser-Cut Wood |
| | 204 | IE | Operations Analysis of Hospital Departmental Consolidation |
| | Red | ME | Solar-Powered Wheelchair Lift |
| | 208 | ME | Single-Step Assembly of a Rotor-Suspension Unit |
| | 213 | PSE | Improving the Reactivity of Cellulose for Enzymatic Processes |
| | 212 | PSE | Measuring Binder Migration Using UV Absorption and IR Spectroscopy |
| 10 | 211 | AAE | Analysis of Fluid Flow in Concentric Rotating Cylinders |
| | 210 | EE | Battery Pack Evaluation and Data Acquisition System |
| | 209 | ET | Assembly and Implementation of Horizontal Storage Carousel |
| | 204 | IE | Analysis of Space Utilization in a Receiving Warehouse |
| | Red | ME | Vacuum Flame Ampoule Sealer |
| | 208 | ME | Gyroscopic Test Chamber Fixture |
| | 213 | PSE | The Effect of Ink Particle and Bubble Size on Flotation De-Inking |
| | 212 | PSE | The Cross-Flow Filtering Concept Used as a De-Inking Method |
| 10:30 | 211 | AAE | Design of a Data Acquisition System for an Automated Wind Tunnel |
| | 210 | EE | Voice Output Communication Aid for the Handicapped |
| | 209 | ET | Implementation of a Computer-Integrated Resin-Drying System |
| | 204 | IE | Improvement of Screw Machine Efficiency |
| | Red | ME | Design of a Forging Experiment |
| | 208 | ME | Redesign of the Pilot Seat for a Cessna 340A |
| | 213 | PSE | The Effect of Coating Lubricants on Boxboard Glueability |
| | 212 | PSE | Effect of pH and Time on Secondary Fiber Surface Area |
| 11 | 211 | AAE | Stability and Control Analysis of WMU's Experimental Aircraft |
| | 210 | EE | Adaptable Airbag System Diagnostic Tool |
| | 209 | ET | Case Study and Implementation of a CIM System |

| Time | Room | Dept. | Topic |
|--------------------|------|-------|---|
| 11 | 204 | IE | Development of Waste Identification and Reporting System |
| | Red | ME | Automated Cast-Cutter Machine |
| | 208 | ME | Automated Preload Assembly for Medical Staplers |
| | 213 | PSE | The Effect of Residual Surfactant on the Retention of Fines |
| | 212 | PSE | Reducing Microbiological Growth Using Ultrasonic Treatment |
| 11:30 | 211 | AAE | Determining the External Structural Loading of an Aircraft |
| | 210 | EE | Fuzzy Logic Controller for a Room Air Conditioner |
| | 209 | ET | Hydromat Set-Up Time Reduction Analysis |
| | 204 | IE | Standardized Protective Packaging for Shipping and Receiving |
| | Red | ME | Redesign of Vibratory Deburring Machine Drive Assembly |
| | 208 | ME | Design of an Impact-Resistant Rotary Joint |
| | 213 | PSE | The Effect of Retention Aids on Water Removal in Alkaline Papermaking |
| | 212 | PSE | Hydraulic Conductivity of Mixtures of Fly Ash and Sludge |
| LUNCH BREAK | | | |
| 1 | 211 | AAE | Design of a Radio-Controlled Airplane |
| | 210 | EE | High-Speed Data-Acquisition System |
| | 209 | ET | Ice Rink Resurfacer Kit for a Riding Lawn Mower |
| | 204 | IE | Ergonomic Analysis to Prevent Repetitive Motion Injuries |
| | Red | ME | The Jar Hopper Project |
| | 208 | ME | Office Chair Tilt-Locking Mechanism |
| | 213 | PSE | Green Liquor Pulping for Corrugating Medium |
| 1:30 | 212 | PSE | The Effect of Wet Pressing on Filler Stratification |
| | 211 | AAE | Experimental Investigation of Jets in a Confined Cross Flow |
| | 210 | EE | Electrical Devices Command Unit |
| | 209 | ET | Development of an Automobile Jack |
| | 204 | IE | Optimization of Material and Supply Distribution for Patient Care |
| | Red | ME | Die Change Optimization |
| | 208 | ME | Design of an X-Ray Film Tray for an Emergency Stretcher |
| 2 | 213 | PSE | Aeration Modeling |
| | 212 | PSE | Ultrasonic De-Inking of Paper Printed with UV-Cured Varnishes |
| | 210 | EE | A Digital Engine Analyzer |
| | Red | ME | Gyroscopic Forces in Non-Symmetrical Bodies |
| | 208 | ME | Core Sampler |
| 2:30 | 213 | PSE | Carbohydrate Protectors for Use in Oxygen Delignification |
| | 212 | PSE | Efficiency of Kajaani in Measuring Length of Dyed Fibers |
| | 210 | EE | Active Two-Node Ultrasonic Distance-Measuring Subsystem |
| | Red | ME | Cellophane Roll-Placer Design |
| 3 | 208 | ME | Conveyor Belt Tester |
| | 212 | PSE | Estimation of Paper Machine Condensate Loading |
| | 208 | ME | Reducing Variation in Window Crank Slots |

AIRCRAFT AND AUTOMOTIVE ENGINEERING

Session Chair - Curt Swanson

Room 211

DESIGN OF A MEASUREMENT SYSTEM FOR VEHICLE INERTIAL PARAMETERS

by Tarig Al-Jabr and Kenneth M. Simpson

Faculty Advisor: Richard B. Hathaway

9 to 9:25 a.m., Room 211

Prediction of vehicle behavior is necessary in the evaluation of handling performance and ride. The mass moment of inertia values about the pitch, roll and yaw axes are an integral part of this prediction. The complex assortment of parts on an automobile makes it extremely difficult to determine inertial quantities from equations. A system has been designed to allow the experimental determination of each of these values, as well as the center of gravity. A computer program guides the user through each step.

FORMULA ENGINE

by William R. deWeever, Steven T. Houtman and Marc V. Musial

Faculty Advisor: Curt Swanson

9:30 to 9:55 a.m., Room 211

A 600-cubic-centimeter high-performance piston engine was optimized for use in the 1991 Formula SAE Race. Rules of the competition state that all incoming air must enter through a single fixed-size air restrictor, which reduces the maximum power output of the engine. The engine intake and exhaust systems were redesigned, and a multi-port fuel injection system was implemented. These modifications dictated changes to other engine variables, including valve and ignition timing.

ANALYSIS OF FLUID FLOW IN CONCENTRIC ROTATING CYLINDERS

by Kathy L. Crankshaw and Monica L. Nemecek

Faculty Advisor: Parviz Merati

10 to 10:25 a.m., Room 211

Turbulent fluid flow between coaxial cylinders was analyzed with the inner cylinder rotating and a stationary wall at one end. FLUENT, a computer program, predicted the flow behavior when a protrusion was mounted on the stationary wall end. Laser Doppler velocimetry and flow visualization using a laser technique were used to verify the results obtained from computer simulation.

DESIGN OF A DATA ACQUISITION SYSTEM FOR AN AUTOMATED WIND TUNNEL

by Ronald Weiss

Faculty Advisor: Parviz Merati

10:30 to 10:55 a.m., Room 211

Software and hardware were designed and implemented to replace a manual method of data collection for airfoil evaluation. Operation of the wind tunnel was upgraded with robotics and a personal computer so that an inexperienced student can obtain quality results. Using a PC and an analog-to-digital expansion card, airfoil evaluation can be accomplished with excellent, repeatable results. The computer managed each test by robotically positioning the airfoil while gathering data on lift, drag and pitching moment.

STABILITY AND CONTROL ANALYSIS OF WMU'S EXPERIMENTAL AIRCRAFT

by Delos J. Boulter, Dennis D. Dauber and Rainer V. Swamy

Faculty Advisors: Arthur Hoadley and Pradipkumar Sagdeo

11 to 11:25 a.m., Room 211

To perform a stability and control analysis of WMU's Cessna R182, control position transducers were designed for measurement of aileron, elevator, flap, and rudder deflections during flight. A control wheel was also designed using strain gages to measure the force a pilot exerts on the control wheel during flight. Control force measurements were used to determine the stability derivatives and stick force of the aircraft in flight. The project also included determination of the aircraft's neutral point, static margin and phugoid mode.

DETERMINING THE EXTERNAL STRUCTURAL LOADING OF AN AIRCRAFT

by Robert Gray, Luis Martos and Mike Phillips

Faculty Advisor: Arthur Hoadley

11:30 to 11:55 a.m., Room 211

Structural analysis of stresses on an aircraft requires knowledge of the magnitude and direction of loads placed on aircraft structures during flight. An experimental method was designed to measure loads on the tail components of a flight test aircraft during various flight maneuvers. The method uses strain gages mounted on the aft section of the fuselage. Electrical output from the gages is conditioned and sent to the on-board computer. Signal conditioning, calibration, transfer function development and computer software design were required.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

DESIGN OF A RADIO-CONTROLLED AIRPLANE

by Roger W. Glas and Jeffrey S. Larsen

Faculty Advisor: Pradipkumar Sagdeo

1 to 1:25 p.m., Room 211

A radio-controlled airplane was designed and built to meet regulations set forth in the 1991 SAE Air Cargo Design Competition. Wind tunnel testing, computer modeling and material selection studies were conducted. The aircraft was flight tested to prove that the theoretical analysis was correct.

EXPERIMENTAL INVESTIGATION OF JETS IN A CONFINED CROSS FLOW

by Tim Bird and Michael Blossfeld

Faculty Advisor: Pradipkumar Sagdeo

1:30 to 1:55 p.m., Room 211

This project investigated the changes in airflow velocity profiles inside a duct when a turbulent, perpendicular jet flow is introduced into the original flow. The resulting airflow characteristics were studied using computer flow visualization techniques and experimental flow studies in a wind tunnel. Resulting flow characteristics have application in tilt rotor aircraft propulsion induction systems.

ELECTRICAL AND COMPUTER SYSTEMS ENGINEERING

Session Chair - John Gesink

Room 210

ELECTRONIC SHIFT LEVER CONTROL UNIT

by Dave Crane, Rick Johnson and Sajjad Kabir

Faculty Advisor: Charles Davis

Industrial Advisor: Bruce Vincent

9 to 9:25 a.m., Room 210

A shift lever control system was designed and built to provide improved shift quality and eliminate cable adjustment problems in heavy-duty trucks. Vehicle environmental and shift information is monitored and controlled by a microprocessor embedded in the control system. Fiber optic technology is used to transmit the control data to the transmission.

DRIVER COMMAND CONSOLE

by Stephen P. Claussen, Tim Farley and Homayon Ghazizadeh

Faculty Advisor: Sami Esmail

Industrial Advisor: Paul M. Menig

9:30 to 9:55 a.m., Room 210

A local manufacturer has developed a microcomputer-controlled, automatic transmission for large-scale trucks. This project involved design of an operator interface, called the Driver Command Console (DCC). The DCC is mounted in the cab of the truck and allows the driver to communicate with the microcomputer controlling the transmission. The driver can select an automatic or manual mode, shift gears, or refer to a digital gear display. Other visual and audible signals inform the driver of suggested and/or critical situations.

BATTERY PACK EVALUATION AND DATA ACQUISITION SYSTEM

by John A. Brown, Scott Straka and Steve A. Tetreau

Faculty Advisor: Joseph Kelemen

Industrial Advisor: Tom Bolkcom

10 to 10:25 a.m., Room 210

A quality assurance test system was developed for a local manufacturer of nickel-cadmium battery packs. Battery charge and discharge stations were designed and interfaced with a personal computer. Computer control allowed acquisition of battery performance data used to evaluate each pack. The system is used in the final step of the manufacturing process of the battery packs.

VOICE OUTPUT COMMUNICATION AID FOR THE HANDICAPPED

by Stephen E. Keeley and Gerald J. LaMarr

Faculty Advisor: Dean Johnson

10:30 to 10:55 a.m., Room 210

An electronic device called the Voice Output Communication Aid (VOCA) was designed and built to help speech-impaired and physically handicapped adults to communicate. VOCA consists of a 20-button keypad, photocell array and voice synthesis circuitry. It allows pre-recorded messages to be played back by touching a picture on a keyboard or by aiming a light beam at the picture. The messages, which can include information about daily activities, are recorded by an instructor and stored in memory. The battery-operated VOCA is small and light enough to be moved from room to room.

ADAPTABLE AIRBAG SYSTEM DIAGNOSTIC TOOL

by Scott Suyak, Todd Witters and Tim Zott

Faculty Advisor: Lambert VanderKooi

Industrial Advisor: Roger A. McCurdy

11 to 11:25 a.m., Room 210

A diagnostic tool was designed and tested for use in pinpointing failures in automotive airbag systems. Because of its ease of use, efficiency and expanded capabilities, the tool is an improvement on those now available. The design has the advantage of being compatible with any automotive airbag system and will be used as a production platform upon which future diagnostic tools may be modeled. Such features as fiber optic communication, a large display screen, user-friendly software, PC compatibility and a parallel printer port have been included.

FUZZY LOGIC CONTROLLER FOR A ROOM AIR CONDITIONER

by Robert Choals, Scott McLauchlin and Paul Slabbekoorn

Faculty Advisor: Frank Severance

Industrial Advisor: Gerald Eisenbrandt

11:30 to 11:55 a.m., Room 210

A fuzzy logic controller was designed, built and tested to replace the mechanical controller of a room air conditioner and provide improved performance, efficiency and comfort. Fuzzy logic is the application of human- type grey area reasoning as opposed to traditional crisp, true/false logic. The design team developed and implemented fuzzy algorithms using the Motorola MC 68705R3 microcontroller.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

HIGH-SPEED DATA-ACQUISITION SYSTEM

by Richard R. Fosmoe, Scott M. Mayhew and Stan L. Seely

Faculty Advisor: Raghvendra Gejji

Industrial Advisors: Tim Theriault, Tom Rehwoldt, Jay Harris and Jack Goodsell

1 to 1:25 p.m., Room 210

A high-speed data-acquisition system was developed for use with flight data recorders. The system records performance characteristics of the aircraft for predictive maintenance. A state-of-the-art high-speed analog-digital converter, high-speed programmable logic device and a personal computer were used.

ELECTRICAL DEVICES COMMAND UNIT

by Richard Budden, Matthew Bush and Cho Sou

Faculty Advisor: Ece Yaprak

Industrial Advisor: Robert Tuttle and Ross Johnson

1:30 to 1:55 p.m., Room 210

To make an office environment more convenient, the on/off capabilities of several devices such as a computer, a light fixture and a space heater were consolidated into a single command unit. A liquid crystal device was used to display an icon for each electrical appliance. When a switch corresponding to a particular display is pressed, a signal is sent to a microprocessor embedded in the console. The microprocessor then activates a relay to provide power to the associated device. The user is informed of this by a highlighted icon.

A DIGITAL ENGINE ANALYZER

by Safieh Arghavani, Michele Decker and Tim Green

Faculty Advisor: Thomas Piatkowski

Industrial Advisor: John Smiley

2 to 2:25 p.m., Room 210

A manufacturer of engine-testing equipment wanted to prototype a new product that is functionally equivalent to but less costly than commercially available engine analyzers. A digital engine analyzer was designed to measure and display the internal combustion engine performance parameters of speed, dwell and advance angle. Conditioned signals from the engine are processed by a Motorola M68HC11 microcontroller, and the specified parameters are presented on a digital display.

ACTIVE TWO-NODE ULTRASONIC DISTANCE-MEASURING SUBSYSTEM

by Randy Hetfield and Chris Yoder

Faculty Advisor: S. Hossein Mousavinezhad

Industrial Advisors: Kevin Davis and Steven DeRyke

2:30 to 2:55 p.m., Room 210

Ultrasonic rangefinders now in use bounce sonar pulses off distant objects and determine distance by measuring the time required for a pulse to make the round trip. These devices cannot, however, operate in a confined area, they do not compensate for changes in the speed of sound due to temperature and humidity, and the pulses may be absorbed or scattered by the reflecting surface. A two-node active ultrasonic distance measuring subsystem was designed that eliminates these problems by placing sonar nodes at each endpoint of the distance to be measured. Each node has a transmitter and receiver. The time required for a message sent by a node to reach its own receiver determines the speed of sound. The distance is calculated by measuring the time required for transmission between nodes.

ENGINEERING TECHNOLOGY
Session Chair - Ralph Tanner
Room 209

COMPARISON OF 32MM AND FACE-FRAME CONSTRUCTION

by Stacy Buss, Joel Cogswell and Brian Ernst

Faculty Advisor: Roman Rabiej

9 to 9:25 a.m., Room 209

Traditional face-framed manufacturing processes were compared to 32mm frameless processes. Data were collected through research and plant tours to prove that the frameless method is more economical. The principal savings are related to labor: less skilled workers are capable of producing high quality cabinets in a shorter time. The producer of high quality cabinets will benefit greatly from use of the 32mm processes.

GLUEABILITY RESTORATION OF LASER-CUT WOOD

by Deron Anderson, Bradley Noble and Razak Saheb

Faculty Advisor: Roman Rabiej

9:30 to 9:55 a.m., Room 209

Cherry, sugar maple and oak wood were prepared and sized to provide a sample lot for investigation of the glueability restoration of laser-cut wood. The geometric error, kerf or angle of the cut, waviness and roughness caused by laser cutting were analyzed. Tests were conducted to evaluate the strength retention of laser-cut wood and what further tasks were needed to restore laser-cut wood glueability.

ASSEMBLY AND IMPLEMENTATION OF HORIZONTAL STORAGE CAROUSEL

by Paul S. Budzynski, Dennis S. Edwards and John A. Endres

Faculty Advisor: Ralph Tanner

10 to 10:25 a.m., Room 209

A commercial automatic storage and retrieval carousel was constructed and implemented in the Advanced Manufacturing Systems Laboratory at Western Michigan University. It is a flexible and versatile station that can be implemented into a work cell in any manufacturing setting. The carousel provides a storage area for parts or stock that can be indexed to a fixed point. It can be used for work-in-process storage, parts storage, kitting, and progressive assembly or any combination of the above. Each function contributes to process optimization and increased productivity.

IMPLEMENTATION OF A COMPUTER-INTEGRATED RESIN-DRYING SYSTEM

by Ted Beugnot, John R. Moskalik and Odie Pruitt III

Faculty Advisor: Paul Englemann

10:30 to 10:55 a.m., Room 209

Moisture must be removed from plastics before they can be processed. At the Western Michigan University Plastics Lab, all drying had been done off-site because of the lack of a dryer. A resin-drying system was obtained, programmed and integrated to a central computer to allow preparation of resin for molding and to allow collection of output data. The system was made mobile to facilitate hook-up with different types of plastic processing equipment.

CASE STUDY AND IMPLEMENTATION OF A CIM SYSTEM

by Chris Bollaert, Kurt Kuipers and Randy Verburg

Faculty Advisors: Michael Atkins and Ralph Tanner

11 to 11:25 a.m., Room 209

An implementation guide was developed for integration of commercially available computer-aided design and computer-aided manufacturing systems to a computer-integrated manufacturing system. Graphics from a number of popular CAD packages were incorporated, and numerically controlled (NC) code was generated. The code was interpreted through the CAD/CAM packages and translated into the graphics representation. The code was then used to create prototypes using NC machines available to Western Michigan University. The documentation discusses problems encountered and solutions developed.

HYDROMAT SET-UP TIME REDUCTION ANALYSIS

by James Carr, James Graham and Denise Yntema

Faculty Advisor: Fred Sitkins

Industrial Advisor: Steve DeVries

11:30 to 11:55 a.m., Room 209

To reduce the tooling set-up time for a hydromat rotary transfer machine, all the tooling necessary to facilitate use of the hydromat was numbered and put in a cabinet within the tooling area for inventory purposes. Pre-set sheets were developed that describe tooling dimensions used to position tools to a specified depth requirement. Computer-formatted machine operation process sheets were revised to inform operators about specific machine parameters and settings. The tools can be placed directly into the machine with reduced handling and operator adjustments.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

ICE RINK RESURFACER KIT FOR A RIDING LAWN MOWER

by Sean M. Pigott, Karl R. Reaume and Troy C. Schilling

Faculty Advisors: Charles Woodward, Pnina Ari-Gur, Ralph Tanner, Fred Sitkins
and Glen Hall

Industrial Advisor: Roy Eaton

1 to 1:25 p.m., Room 209

An ice resurfacer kit was designed and prototyped for adaptation to any common riding lawn mower. The system shaves the ice, collects the shavings and applies a layer of water to create a smooth surface. It allows construction and maintenance of an ice rink in a backyard, neighborhood pond or on a lake without an extensive investment of time and money.

DEVELOPMENT OF AN AUTOMOBILE JACK

by Doug Dietz and Dave Shafer

Faculty Advisor: Charles Woodward

1:30 to 1:55 p.m., Room 209

For the past decade, auto makers have been trying to design and build cheaper, lighter and more fuel-efficient vehicles. A light-weight, stable, economical and user-friendly car jack was designed. The design analysis included research on unique drive mechanisms, electric motor, storage size and use of finite element analysis to analyze the structure. Plastic prototypes were constructed.

INDUSTRIAL ENGINEERING

Session Chair - Joseph W. Petro Jr.
Room 204

FEASIBILITY OF BAR CODING IN A UNIVERSITY

by Hassan Albadr and Nassar Ibrahim

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisors: David Lake, Helen Healy, Arvon Farrell, Robert Wygant, Greg Lozeau and Lowell Rinker

9 to 9:25 a.m., Room 204

An engineering analysis was conducted to determine the feasibility of using a bar code system for fixed asset control, receiving and delivery accuracy and preventive maintenance of computer equipment. The study included determination of system requirements, an evaluation of system compatibility to existing bar code applications, vendor selection and a cost/benefit analysis.

OPERATIONS ANALYSIS OF HOSPITAL DEPARTMENTAL CONSOLIDATION

by Thomas Burdgick, Rhonda L. Tiller and Hoa Q. Tran

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisors: John Ryder, Dan Green and Dan Zeitler

9:30 to 9:55 a.m., Room 204

An operations analysis was performed to determine time standards, process flow charts and work loads for two independent hospital departments that were being combined and relocated to a single area. Time studies, historical data, direct observations and Delphi studies were performed. The data were compiled and analyzed. New time standards and process flow charts were determined, and staffing recommendations were made.

ANALYSIS OF SPACE UTILIZATION IN A RECEIVING WAREHOUSE

by Roman M. Bohatch, Brian S. Johnson and Nhung C. Tran

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisor: Mark Wallace

10 to 10:25 a.m., Room 204

The receiving function of a large cable manufacturer included several activities such as handling pass-through products, product staging, receiving inspection and component parts distribution to the production floor. Severe space constraints necessitated an analysis to improve material flow, ordering policies and overall space utilization. Through modifications of plant layout, material storage and scheduling, the space utilization of the receiving warehouse was improved to the extent that no immediate additional floor space was required.

IMPROVEMENT OF SCREW MACHINE EFFICIENCY

by Todd Greer, Kengo Kuwamura and Brent Yager

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisors: Ken Lundquist and Rick Koenig

10:30 to 10:55 a.m., Room 204

A company that produces brass fittings has had difficulty maintaining an acceptable level of production efficiency in a central department that uses 45 screw machines. Possible causes for the low production performance were investigated. Work sampling was used to determine the proportions of total time devoted to the various productive and non-productive activities. Time studies and work methods analysis were conducted of these operations, and recommendations were made to improve efficiency.

DEVELOPMENT OF WASTE IDENTIFICATION AND REPORTING SYSTEM

by Paul W. Kellogg and Benjamin F. Ora

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisor: Mark Mizikar

11 to 11:25 a.m., Room 204

In a plant in which raw materials account for 50% of operating cost, there was no system to identify or measure material waste. The overall waste factor was identified, and opportunities for recycling and cost control were determined. A plant-wide material waste reporting system was developed which will allow management to identify and reduce specific areas of waste.

STANDARDIZED PROTECTIVE PACKAGING FOR SHIPPING AND RECEIVING

by Jordan Beltz, Andy Matusko and Jeff Spray

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisor: Linn R. Adams

11:30 to 11:55 a.m., Room 204

A company which manufactures parts and ships them to outside vendors for plastic coating was incurring damage to the parts during transit because of insufficient packaging protection. Standard, cost-efficient packaging was designed to protect parts from damage. Packaging specifications, reusable racks, hangers and dividers were developed for use in shipping a variety of parts to and from vendors.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

ERGONOMIC ANALYSIS TO PREVENT REPETITIVE MOTION INJURIES

by Stephen Homrich, John Kapolka and Moravia Carvajal-Smead

Faculty Advisor: Joseph W. Petro Jr. and Robert Wygant

Industrial Advisor: Pat Durante

1 to 1:25 p.m., Room 204

Method and ergonomic studies were conducted on employee usage of carton-filling and case-packing machines. Recommendations were made to modify work methods and job design to prevent repetitive motion injuries.

OPTIMIZATION OF MATERIAL AND SUPPLY DISTRIBUTION FOR PATIENT CARE

by Stephen Bishop and Linda Van Horn

Faculty Advisor: Joseph W. Petro Jr.

Industrial Advisors: Michael S. Way and Pamela S. Franssen

1:30 to 1:55 p.m., Room 204

The material and supply distribution system for nursing stations, linen and medical forms was analyzed to determine optimum product requirements, stocking levels and storage locations in a hospital. The floor material coordinator's function was standardized, and a job description was developed.

MECHANICAL ENGINEERING - SESSION A

Session Chair - Jerry Hemmye

Red Rooms A and B (First Floor)

ANALYSIS OF THE PULSED FLOW OF A SURGICAL IRRIGATION SYSTEM

by Eric Hansen and Ruth A. Hilsbos

Faculty Advisor: Philip Guichelaar

Industrial Advisors: James Evans and James Kerr

9 to 9:25 a.m., Red Rooms A and B

The pulsing of a pump/nozzle system flow was evaluated and modeled. The hand-held system is used to irrigate and clean trauma and joint surgery sites. The manufacturer needed specific knowledge of the fluid flow damping caused by the pump and each of the interchangeable nozzles in order to develop a new pump system that will use the current nozzles. A test was designed to determine the viscous damping effect of each of the various components of the system. Data from the test were used to develop an equation of flow for each component.

SOLAR-POWERED WHEELCHAIR LIFT

by Steve Kraski and Andrew Soles

Faculty Advisor: Philip Guichelaar

Industrial Advisors: Dave Brigolin and Mark Hickey

9:30 to 9:55 a.m., Red Rooms A and B

A hydraulic lift was designed as an alternative to ramps and low-rise elevators to raise and lower handicapped individuals. The hydraulic system is powered by solar energy and equipped with a back-up power supply.

VACUUM FLAME AMPOULE SEALER

by Charles R. Whitman

Faculty Advisor: Philip Guichelaar

10 to 10:25 a.m., Red Rooms A and B

A laboratory procedure requires the sealing of a sample within a glass ampoule with oxygen removed. In the past, the process of oxygen removal and sealing of the ampoule was carried out by hand, using a vacuum pump and Bunsen burner, and leading to inconsistencies in results and injuries to operators. A laboratory device was developed that does not require an operator and that makes possible validation of the process.

DESIGN OF A FORGING EXPERIMENT

by Sean C. Meeks and Patrick J. Santavy

Faculty Advisor: Philip Guichelaar

10:30 to 10:55 a.m., Red Rooms A and B

A laboratory exercise was developed to introduce various concepts of forging practice to engineering students. A theoretical model was used to calculate the forces required to forge a lead sample. Dies were designed and constructed using a finite element analysis software package. Dies were mounted to a tensile testing machine, samples were forged, and the actual forces required to produce the parts were recorded. Variations between actual force measurements and theoretical calculations were analyzed.

AUTOMATED CAST-CUTTER MACHINE

by Jeff Arnett and Mark Pratley

Faculty Advisor: Jerry Hemmye

Industrial Advisor: James Kerr

11 to 11:25 a.m., Red Rooms A and B

Broken bones are set using fiberglass or plaster casts. A special saw is used to remove the casts. A machine was designed and built that automatically performs the cutting operation on test casts so that blade tooth wear can be evaluated. The machine satisfies the criteria of reduced manual labor and reduced operator exposure to dust.

REDESIGN OF VIBRATORY DEBURRING MACHINE DRIVE ASSEMBLY

by Mark R. Benner and Mark E. Borton

Faculty Advisor: Jerry Hemmye

Industrial Advisor: Michael Carl

11:30 to 11:55 a.m., Red Rooms A and B

Vibratory deburring machines are used to deburr and polish small metal castings. The machines consist of one to three drive mechanisms. A drive mechanism uses counterweights, bearings, a V-belt and a shaft to obtain a vibratory motion. A dynamic analysis was performed on the assembly, and a modified pulley/masterweight casting design was recommended to improve bearing life.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

THE JAR HOPPER PROJECT

by Fadi M. Kouja

Faculty Advisor: Jerry Hemmye

Industrial Advisor: Hani Akel

1 to 1:25 p.m., Red Rooms A and B

Small plastic jars to be filled with formaldehyde for use in storing and transporting tissue specimens in hospitals and laboratories had been oriented and fed onto an assembly line manually. A machine was designed to do the same thing faster.

DIE CHANGE OPTIMIZATION

by Stephen J. Hollingsworth and Jeffrey G. Todd

Faculty Advisor: Jerry Hemmye

Industrial Advisor: Jeff Norr

1:30 to 1:55 p.m., Red Rooms A and B

In the plastics injection molding industry, the changing of dies (molds) can be a major source of problems. Any time that a machine is down during a die change lowers productivity. By applying "single minute exchange of die" philosophies and reducing the amount of time required to change a die, machine productivity was greatly enhanced.

GYROSCOPIC FORCES IN NON-SYMMETRICAL BODIES

by John Cathcart and Doug Wales

Faculty Advisor: Jerry Hemmye

Industrial Advisor: Ross Swain

2 to 2:25 p.m., Red Rooms A and B

A local plastic-molding firm wants to develop as an advertising specialty a form which will spin only counter-clockwise. The effects on gyroscopic behavior of mass distribution and symmetry were studied, and an optimization study was completed.

CELLOPHANE ROLL-PLACER DESIGN

by Alan Ives and Brian Stanley

Faculty Advisor: Jerry Hemmye

Industrial Advisor: Tim Summers

2:30 to 2:55 p.m., Red Rooms A and B

A machine that applies cellophane windows to packaging cartons requires manual replacement of cellophane rolls as they are used. A transfer mechanism was designed to assist the operator in the replacement of the rolls.

MECHANICAL ENGINEERING - SESSION B

Session Chair - Dennis VandenBrink

Room 208

LEAF-BALING SYSTEM

by Andy Devota and Mark Schuch

Faculty Advisor: Martin Schroeder

Industrial Advisor: Patrick Hallauer

9 to 9:25 a.m., Room 208

Ordinances banning leaf burning have made the removal of leaves expensive and tedious for the homeowner and the city. A leaf-baling technique was developed to allow for a manageable way of collecting and compacting leaves. Marketability and safety were taken into account during the building and testing of the prototype.

SINGLE-STEP ASSEMBLY OF A ROTOR-SUSPENSION UNIT

by Ron R. Stutz

Faculty Advisor: Judah Ari-Gur

Industrial Advisor: Donald G. Eenigenburg

9:30 to 9:55 a.m., Room 208

The suspension and rotor unit is an important component of the dynamically tuned gyroscope. The present assembly procedure requires several trials and two to four hours of technician time to position the suspension correctly in the rotor. A single-step placement method was developed to reduce assembly time.

GYROSCOPIC TEST CHAMBER FIXTURE

by Theresa M. Schluter

Faculty Advisor: Judah Ari-Gur

Industrial Advisors: Hoyt Carriker and Donald G. Eenigenburg

10 to 10:25 a.m., Room 208

A new design was developed for a rotating gyroscope fixture in a temperature test chamber. The fixture securely holds four gyroscopes throughout a wide range of temperatures and position changes within the tight test space of a chamber. Computer-aided design was used to generate and finalize the design.

REDESIGN OF THE PILOT SEAT FOR A CESSNA 340A

by Michael C. Beck and Brian A. Peters

Faculty Advisor: Judah Ari-Gur

Industrial Advisor: Dennis Vanstrien

10:30 to 10:55 a.m., Room 208

The pilot seat of a Cessna 340A was ergonomically redesigned to provide optimum comfort, safety and accessibility for the 6'4" pilot/owner. The modified seat was designed for additional adjustment while meeting the Federal Aviation Administration static and dynamic load codes and maintaining visual and reach accessibility standards. The entire project was coordinated with the FAA and formally submitted to the FAA office for universal application in all Cessna 340A airplanes.

AUTOMATED PRELOAD ASSEMBLY FOR MEDICAL STAPLERS

by Stuart Peterson and Ron Yair

Faculty Advisor: Judah Ari-Gur

Industrial Advisor: Mark Penrod

11 to 11:25 a.m., Room 208

Disposable medical staplers are currently assembled using manual processes. A pinning procedure takes about one third of the stapler production time. An automatic preload pinning mechanism has been developed to reduce the time spent during this step. The proposed design saves more than 50% of the time now needed at the station and allows for modifications to pin several staplers at one time.

DESIGN OF AN IMPACT-RESISTANT ROTARY JOINT

by Kevin B. Jones and James A. Medsker

Faculty Advisor: Judah Ari-Gur

Industrial Advisors: Gerry Timm and Jeff Monroe

11:30 to 11:55 a.m., Room 208

Paper build-up often sticks to the rotating steel drums used in the paper industry and distorts the roundness of the drums. As a result, impact loads are generated that destroy the sealed rotary joints located on the drums. A new design was developed for the rotary joints that is more compact and prevents failures.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

OFFICE CHAIR TILT-LOCKING MECHANISM

by Randall S. Purdy and Steven L. Sanders

Faculty Advisor: Dennis VandenBrink

Industrial Advisor: Thomas Niergarth

1 to 1:25 p.m., Room 208

A mechanism was designed to lock the tilt of an office chair at several positions throughout the range of tilting motion. The locking mechanism was incorporated into the current tilting mechanism.

DESIGN OF AN X-RAY FILM TRAY FOR AN EMERGENCY STRETCHER

by Jon T. Lea and Ronald J. Pascuzzi

Faculty Advisor: Dennis VandenBrink

Industrial Advisors: Martin Stryker and Richard Bartow

1:30 to 1:55 p.m., Room 208

A tray was designed to position x-ray film beneath a patient lying on an emergency stretcher. The new tray and stretcher combination eliminates the need to transfer a patient between an x-ray table and a standard stretcher. The tray centers the film under the patient mechanically and is easily accessible from either side.

CORE SAMPLER

by James Tarne

Faculty Advisor: Jerry Hamelink

Industrial Advisors: David Pinto and Mike Pinto

2 to 2:25 p.m., Room 208

An earth core sampling tool was designed and prototyped that will substantially reduce the risk of cross contamination between consecutive test specimens. Material selection was based on cost and resistance to corrosion.

CONVEYOR BELT TESTER

by David MacKellar and David Phaneuf

Faculty Advisor: Jerry Hamelink

Industrial Advisors: Steve Szarkowski and Dave Cotter

2:30 to 2:55 p.m., Room 208

The producer of various industrial conveyor systems needed performance information for certain conveyor parts to ensure reliability. An accelerated test and testing device were designed to determine conveyor component performance.

REDUCING VARIATION IN WINDOW CRANK SLOTS

by Scott Frens

Faculty Advisor: Jerry Hamelink

Industrial Advisor: Ray Beerhorst

3 to 3:25 p.m., Room 208

A machine used to process automobile window cranks was producing large amounts of scrap. The window cranks are milled for the knob and sawed for a clip at a station on the machine. The slot width cutting capability was redesigned to reduce the scrap rate.

PAPER SCIENCE AND ENGINEERING - SESSION A

Session Chair - Ellsworth Shriver

Room 213

HOT-SOFT CALENDERING AS A PRE-TREATMENT

by Andrew L. Tanner

Faculty Advisor: James E. Kline

9 to 9:25 a.m., Room 213

Hot-soft calendering, which uses a heated steel roll coupled with a rubber roll, was used as a pre-treatment for off-machine coating. Pre-treatment resulted in a smoother sheet with more uniform density. The sheet was then coated using a pilot coater. The final coated sheet has increased smoothness and will absorb fluids evenly and allow for uniform binder migration. Uniform binder migration decreases the amount of mottle in the sheet's appearance.

IMPROVING THE REACTIVITY OF CELLULOSE FOR ENZYMATIC PROCESSES

by Anthony J. Misiak

Faculty Advisor: Raymond L. Janes

9:30 to 9:55 p.m., Room 213

Cellulose enzymatic reaction rates are very low because of the partly crystalline nature of the molecule. Milling to small fiber size and swelling in alkali were used to make the crystalline region more accessible to enzymes. The enzymatic products desired included ethanol and methane.

THE EFFECT OF INK PARTICLE AND BUBBLE SIZE ON FLOTATION DE-INKING

by Bruce D. Bentley

Faculty Advisor: Raymond L. Janes

10 to 10:25 a.m., Room 213

Flotation de-inking, one of the most popular methods of removing ink from paper to be recycled, uses chemical and mechanical means to separate ink particles from fibers and then carries them away with air bubbles. Although the process is widely used, little is known about the mechanisms involved. The de-inking efficiency of different ink particle sizes with different bubble sizes was compared, and the optimum bubble size for a given ink particle size was determined.

THE EFFECT OF COATING LUBRICANTS ON BOXBOARD GLUEABILITY

by James R. O'Brien Jr.

Faculty Advisor: Raymond L. Janes

Industrial Advisor: Paul H. Stofer

10:30 to 10:55 a.m., Room 213

Lubricants are added to coating formulations to modify coating slurry viscosity and to alter surface characteristics of the coated sheet. Coating surface characteristics have a major effect on the amount of strength a hot-melt glue bond can develop. Calcium stearate and polyethylene glycol coating lubricants were added at different levels to a typical boxboard coating formulation. The coated boxboard was tested on a Waldorf hot-melt glue bond simulator and tester, and the results were analyzed.

THE EFFECT OF RESIDUAL SURFACTANT ON THE RETENTION OF FINES

by Steven L. Myers

Faculty Advisor: Raymond L. Janes

11 to 11:25 a.m., Room 213

Surfactants are organic chemicals used in the paper industry for washing, de-inking and de-foaming. Residual amounts of surfactants in the papermaking stock will reduce the retention of fines (particles passing a 200-mesh screen) and fiber on a paper machine. This study determined the critical concentrations of these surfactants to adversely affect the retention. The results were used to develop an explanation for the retention losses.

THE EFFECT OF RETENTION AIDS ON WATER REMOVAL IN ALKALINE PAPERMAKING

by Michael M. Brenner

Faculty Advisor: Raymond L. Janes

11:30 to 11:55 p.m., Room 213

Retention aids are microparticles or polymers which have been given an electrostatic charge by chemical means to bind small particles in papermaking furnishes and prevent their loss during the paper-forming operation. The effects of retention aids on the efficiency of water removal from the papermaking furnish are less well known. Experiments were conducted on the pilot paper machine in McCracken Hall at Western Michigan University using three common retention aid systems. Samples and data were collected and tested. The effects of each system on water removal were noted, and the characteristics of each system were interpreted.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

GREEN LIQUOR PULPING FOR CORRUGATING MEDIUM

by Michael G. Thompson

Faculty Advisor: Ellsworth H. Shriver

1 to 1:25 a.m., Room 213

Green liquor in a pulp mill occurs as a water solution of the smelt from a furnace used to recover inorganic chemicals. If green liquor could be used directly in a high-yield pulping operation, the capital requirements for the chemical recovery system could be reduced substantially. Studies using aspen chips involved three concentration levels of green liquor-producing pulps which were compared to pulps from three concentration levels of neutral sulfite semi-chemical (NSSC) liquor. NSSC is the most common pulping process for corrugating medium, but recovery systems are capital-intensive. The pulps were evaluated for yield and various strength properties. It was found that the green liquor pulps had lower strength properties than the NSSC pulps.

AERATION MODELING

by Daniel P. Krieger

Faculty Advisor: Ellsworth H. Shriver

Industrial Advisor: Roger Smithe

1:30 to 1:55 a.m., Room 213

Oxygen is required by the microorganisms that break down the organics in waste water. A secondary waste-water treatment plant was running an oxygen-deficient aeration system. Data were collected from the aeration basins to determine the amount of oxygen transfer that was occurring and the amount of oxygen that was still needed. A recommendation was made on how to improve the aeration basin.

CARBOHYDRATE PROTECTORS FOR USE IN OXYGEN DELIGNIFICATION

by Joey L. Klinge

Faculty Advisor: Ellsworth H. Shriver

2 to 2:25 p.m., Room 213

Carbohydrate degradation limits the amount of delignification achievable during oxygen bleaching. Metal ions found in pulpwood react with oxygen to form free radicals that randomly attack the fiber's molecular structure. Carbohydrate protectors function by precipitating hydroxides that absorb the metal ions, making them unavailable for reaction. Laboratory scale oxygen delignification was performed to determine the effectiveness of two prospective carbohydrate protectors in comparison to the industrially accepted magnesium salts.

PAPER SCIENCE AND ENGINEERING - SESSION B

Session Chair - Richard W. Flores

Room 212

OPTIMUM USE OF POLYMERS FOR SETTLING OF FILAMENTOUS BACTERIA

by Denise A. Polderman

Faculty Advisor: Jay P. Unwin

9 to 9:25 a.m., Room 212

Water treatment is a separation process to remove (among other things) oxygen-consuming biological material from waste water. In treatment using biological organisms to consume water-soluble biological materials, it is desirable subsequently to remove these biological organisms by settling in a clarifier. In a nutrient-limited situation, these organisms may not settle and will have a filamentous structure. Usually chlorine is added to a clarifier to kill and settle these filamentous organisms, but it has the disadvantage that it is a broad-spectrum bactericide and forms unsafe chlorinated compounds. A particular type of charge and molecular weight polymer were recommended to achieve settling.

MEASURING BINDER MIGRATION USING UV ABSORPTION AND IR SPECTROSCOPY

by C. Anthony Chatman

Faculty Advisor: James E. Kline

9:30 to 9:55 a.m., Room 212

The movement of adhesive towards the surface of a coated sheet (binder migration) has adverse effects on the physical and optical properties of coated paper. Two methods of analyzing the amount of binder migration are infrared spectroscopy and ultraviolet light absorption. Although these two methods are widely accepted, they have never been compared quantitatively. This project compared the ability of each method to measure the surface content of styrene-butadiene, a popular paper coating binder (adhesive).

THE CROSS-FLOW FILTERING CONCEPT USED AS A DE-INKING METHOD

by Gregory E. Gourlay

Faculty Advisor: William K. Forester

10 to 10:25 p.m., Room 212

The aim of this project was to determine if the cross-flow filtering concept could be used to de-ink a newsprint and coated groundwood furnish. The filter consists of a screen which is surrounded by a pressure sleeve, and the principle of operation is the differential pressure between the two. The stock velocity through the filter is critical to keep the screen from plugging. Two filters have been manufactured which made up a type of counter-current washing system. Image analysis techniques were used to determine the average ink particle diameter, and the pulp brightness was found to be a measure of the filter's effectiveness.

EFFECT OF pH AND TIME ON SECONDARY FIBER SURFACE AREA

by Daniel R. Norey

Faculty Advisor: William K. Forester

10:30 to 10:55 a.m., Room 212

In general, recycled fibers have poorer fiber-to-fiber bonding than virgin fibers. Conditions which cause recycled fiber swelling and increased surface area will result in better fiber bonding. The intent of this project was to determine the effects of pH and time of soaking in water on secondary fiber swelling and surface area. The secondary fibers used were newsprint and double kraft lined, also known as container plant cuttings. Tests used to reveal the fiber changes included coarseness (weight per unit length), freeness (drainage rate of the fibers), water retention value (affinity of pulp toward water), Kajaani (average fiber lengths) and scanning electron microscope (measures S-2 wall thickness and fiber surface area).

REDUCING MICROBIOLOGICAL GROWTH USING ULTRASONIC TREATMENT

by Mark A. Gill

Faculty Advisor: William K. Forester

11 to 11:25 a.m., Room 212

Microbiological growth can cause major problems in many areas of a paper machine system. Chemicals called biocides are used to reduce the amount of microbiological growth. These chemicals can affect machine wear and must be considered in the effluent stream. The inhibition rates and economics of using ultrasonic treatment were compared to those achieved when biocides are used.

HYDRAULIC CONDUCTIVITY OF MIXTURES OF FLY ASH AND SLUDGE

by Christine J. Lupu

Faculty Advisor: C. Van Maltby

11:30 to 11:55 a.m., Room 212

Two major sources of waste in the pulp and paper industry are fly ash from the combustion of wood and coal, and waste-water treatment sludge. Landfill disposal is presently used for disposal of these wastes. Clay is the common hydraulic barrier material for landfills. It would be beneficial to companies if, instead of clay, they could use as a barrier waste materials already on site. This study examined hydraulic conductivity of a mixture of equal parts of fly ash and sludge.

LUNCH BREAK, 12 TO 1. YOU MAY TAKE YOUR LUNCH TO RED ROOM C.

THE EFFECT OF WET PRESSING ON FILLER STRATIFICATION

by Patrick T. Gish

Faculty Advisor: James E. Kline

1 to 1:25 p.m., Room 212

Stratification is the change in vertical distribution of sheet fiber and filler caused by fluid shear forces during the dynamic wet pressing process. The effect of wet press pressure upon the stratification of filler with the paper web was studied. A wet press simulator was used to stratify paper samples using different degrees of pressure. The samples were split with a Beloit sheet splitter, and each layer was analyzed for filler content.

ULTRASONIC DE-INKING OF PAPER PRINTED WITH UV-CURED VARNISHES

by Tate L. Snell

Faculty Advisor: Raja G. Aravamuthan

1:30 to 1:55 p.m., Room 212

One of the problems associated with the recycling of paper is the removal of ink (de-inking). Some of the hardest papers to de-ink are those coated with an overprint varnish. This varnish is typically found on magazine covers and imparts smoothness and gloss to the sheet. Conventional de-inking procedures use a flotation technique where air bubbles and a chemical are used to liberate the ink. This technique is not totally adequate because ink specks appear. In an attempt to solve this problem, an electrical sonolator was used to de-ink samples at consistencies between 3 and 8 percent. The de-inked stock was made into handsheets, which were compared to handsheets made after a conventional de-inking procedure. The handsheets were examined for optical and strength properties.

EFFICIENCY OF KAJAANI IN MEASURING LENGTH OF DYED FIBERS

by Joanna L. Kingsley

Faculty Advisor: Raja G. Aravamuthan

2 to 2:25 p.m., Room 212

Fiber length is an important characteristic of papermaking pulps and affects all strength properties. The Kajaani FS-100 is a device that measures the length of paper-making wood fibers by means of electronic circuitry and the use of polarized light for length detection. The polarized light will reflect differently from dyed fibers compared to white fibers and influence length measurement. Several different wood pulp furnishes were dyed with standard dyes. Fibers were analyzed before and after dyeing to determine the efficiency of the Kajaani in measuring the length of the dyed fibers. Discrepancies caused by the dyes were rationalized, and methods were suggested to compensate for dyes during Kajaani length measurement.

ESTIMATION OF PAPER MACHINE CONDENSATE LOADING

by Richard L. Lull

Faculty Advisor: Raja G. Aravamathan

Industrial Advisor: Gerry Timm

2:30 to 2:55 p.m., Room 212

A computer program was written that can be used as a tool in equipment sizing and paper machine trouble-shooting. The program estimates the amount of steam condensed during paper drying. It takes into account the factors of condensate film thickness, paper contact coefficient, machine speed, steam pressure and other variables, such as drying surface area and hourly production rate, that can affect drying. The program uses all of these factors in a dryer-by-dryer analysis of the entire dryer section.

Western Michigan University

Western Michigan University is a Carnegie Doctoral I institution, the only one of its kind in the state, and one of the state's five graduate-intensive universities. It enrolls approximately 26,000 students, with about 25% at the graduate levels.

The College of Engineering and Applied Sciences

Undergraduate curricula offered by the College of Engineering and Applied Sciences include:

- aircraft and automotive engineering
- aircraft maintenance engineering technology
- automotive technology and management
- aviation technology and operations
- computer systems engineering
- construction science and management
- electrical engineering
- engineering graphics
- engineering metallurgy
- industrial design
- industrial engineering
- manufacturing administration
- manufacturing engineering technology
- mechanical engineering
- paper engineering
- paper science
- printing
- production technology

The undergraduate programs in electrical, computer systems, industrial, and mechanical engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. The undergraduate program in manufacturing engineering technology is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

The College of Engineering and Applied Sciences offers six Master of Science degree programs: electrical engineering, engineering management, industrial engineering, operations research, mechanical engineering, and paper science and engineering.

Research Facilities

The College of Engineering and Applied Sciences has unique, varied, and well-equipped facilities and laboratories for research.

The Department of Electrical Engineering supports six laboratories. There are also two RF shielded rooms, an anechoic chamber, and special facilities for research in fiber optics, plasma, and microcomputers.

The Center for Lost Foam Casting is expanding the knowledge base for the metal casting process that uses evaporative foam patterns. It works in partnership with industry, providing research, development and consulting.

The Department of Mechanical Engineering includes the facilities of three research institutes: the Applied Mechanics Institute, the Materials Institute for Innovation and Enterprise, and the Energy Research Institute. The facilities include very large capacity load frames, extensive composite materials test facilities, and alternative energy source laboratories.

A unique feature of the Department of Paper and Printing Science and Engineering is the complete paper and printing research and development center. The center includes a Sunds digester defibrator, a 24-inch-wide paper machine, an aqueous coater, a solvent coater, super calender, a fiber recycling pilot plant, and a completely equipped printing facility.

The Department of Industrial Engineering has laboratories for research in computer-controlled manufacturing, human performance, and ergonomics. It is also the headquarters for the International MODAPTS (MODular Arrangement of Predetermined Time Standards) Association.

The Paper and Printing Pilot Plants, the Applied Mechanics Institute, the Energy Research Institute, and the Materials Institute for Innovation and Enterprise all support applied and industry-sponsored research.

Partnership With Business and Industry

The university and the College of Engineering and Applied Sciences recognize the need for an active partnership between business and higher education. They are committed to putting their resources to work in an alliance with business and government to ensure the economic development of the region and state. The college provides seminars, workshops, professional development opportunities, consulting, research and development, and co-op students for businesses in the West Michigan area.

For More Information

For more information about the College of Engineering and Applied Sciences, call (616) 387-4017 or write College of Engineering and Applied Sciences, Western Michigan University, Kalamazoo, MI 49008-5062.

Thank You

The College of Engineering and Applied Sciences is grateful to the following firms, which have provided or cooperated in Senior Engineering Design Projects being presented in April 1991. If you have a project for our students, or if you would like more information about a specific project, please call Linda Hager at (616) 387-4017.

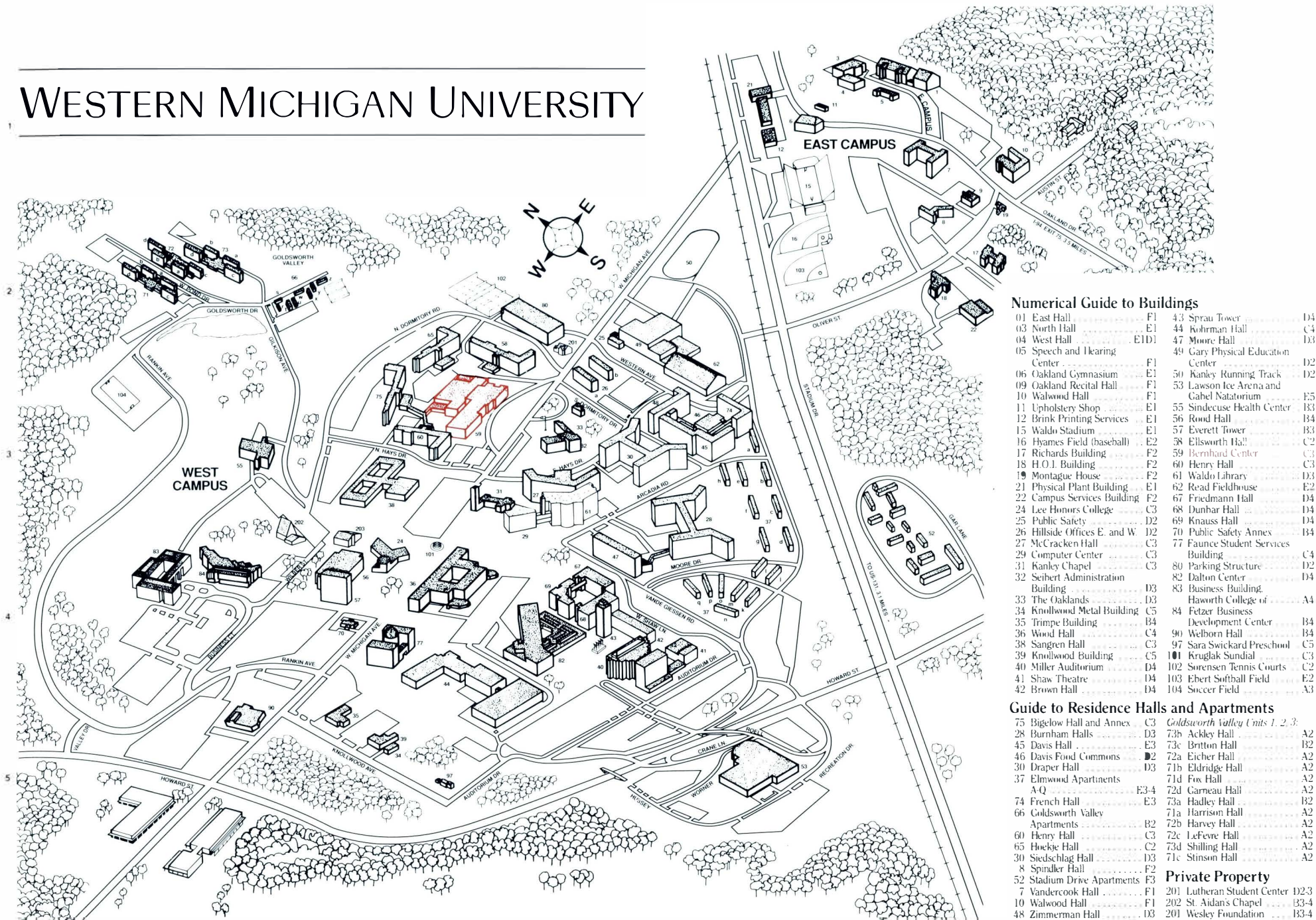
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Steering Committee

Members of the committee which planned this Conference on Senior Engineering Design Projects are John Gesink (chair), Jerry Hemmye, Joseph Petro, Ellsworth Shriver, Curt Swanson and Ralph Tanner.

Western Michigan University makes no representation that the material presented as a result of Senior Engineering Design Projects is error-free or complete in all respects. Persons or organizations who choose to use the material do so at their own risk.

WESTERN MICHIGAN UNIVERSITY



Numerical Guide to Buildings

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| 01 East Hall | F1 | 43 Sprau Tower | D4 |
| 03 North Hall | E1 | 44 Kohrman Hall | C4 |
| 04 West Hall | E1D1 | 47 Moore Hall | D3 |
| 05 Speech and Hearing Center | F1 | 49 Gary Physical Education Center | D2 |
| 06 Oakland Gymnasium | F1 | 50 Kanley Running Track | D2 |
| 09 Oakland Recital Hall | F1 | 53 Lawson Ice Arena and Gabel Natatorium | E5 |
| 10 Walwood Hall | F1 | 55 Sindecuse Health Center | B3 |
| 11 Upholstery Shop | E1 | 56 Rood Hall | B4 |
| 12 Brink Printing Services | E1 | 57 Everett Tower | B3 |
| 15 Waldo Stadium | E1 | 58 Ellsworth Hall | C2 |
| 16 Hyames Field (baseball) | E2 | 59 Bernhard Center | C3 |
| 17 Richards Building | F2 | 60 Henry Hall | C3 |
| 18 H.O.I. Building | F2 | 61 Waldo Library | D3 |
| 19 Montague House | F2 | 62 Read Fieldhouse | E2 |
| 21 Physical Plant Building | E1 | 67 Friedmann Hall | D4 |
| 22 Campus Services Building | F2 | 68 Dunbar Hall | D4 |
| 24 Lee Honors College | C3 | 69 Knauss Hall | D4 |
| 25 Public Safety | D2 | 70 Public Safety Annex | B4 |
| 26 Hillside Offices E. and W. | D2 | 77 Faunce Student Services Building | C4 |
| 27 McCracken Hall | C3 | 80 Parking Structure | D2 |
| 29 Computer Center | C3 | 82 Dalton Center | D4 |
| 31 Kanley Chapel | C3 | 83 Business Building | D3 |
| 32 Seibert Administration Building | D3 | 84 Haworth College of Development Center | B4 |
| 33 The Oaklands | D3 | 90 Welborn Hall | B4 |
| 34 Knollwood Metal Building | C5 | 97 Sara Swickard Preschool | C5 |
| 35 Trimpe Building | B4 | 101 Kruglak Sundial | C3 |
| 36 Wood Hall | C3 | 102 Sorensen Tennis Courts | C2 |
| 38 Sangren Hall | C4 | 103 Ebert Softball Field | E2 |
| 39 Knollwood Building | C5 | 104 Soccer Field | A3 |
| 40 Miller Auditorium | D4 | | |
| 41 Shaw Theatre | D4 | | |
| 42 Brown Hall | D4 | | |

Guide to Residence Halls and Apartments

| | | | |
|---------------------------------|------|---------------------------------|----|
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| 28 Burnham Halls | D3 | 73b Ackley Hall | B2 |
| 45 Davis Hall | E3 | 73c Britton Hall | B2 |
| 46 Davis Food Commons | D2 | 72a Eicher Hall | A2 |
| 30 Draper Hall | D3 | 71b Eldridge Hall | A2 |
| 37 Elmwood Apartments | D3 | 71d Fox Hall | A2 |
| A-Q | E3-4 | 72d Garneau Hall | A2 |
| 74 French Hall | E3 | 73a Hadley Hall | B2 |
| 66 Goldsworth Valley Apartments | B2 | 71a Harrison Hall | A2 |
| 60 Henry Hall | C3 | 72b Harvey Hall | A2 |
| 65 Hoekie Hall | C2 | 72c LeFevre Hall | A2 |
| 30 Siedschlag Hall | D3 | 73d Shilling Hall | A2 |
| 8 Spindler Hall | F2 | 71c Stinson Hall | A2 |
| 52 Stadium Drive Apartments | F3 | | |
| 7 Vandercook Hall | F1 | | |
| 10 Walwood Hall | F1 | | |
| 48 Zimmerman Hall | D3 | | |

Private Property

| | |
|-----------------------------|------|
| 201 Lutheran Student Center | D2-3 |
| 202 St. Aidan's Chapel | B3-4 |
| 201 Wesley Foundation | B3-4 |

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