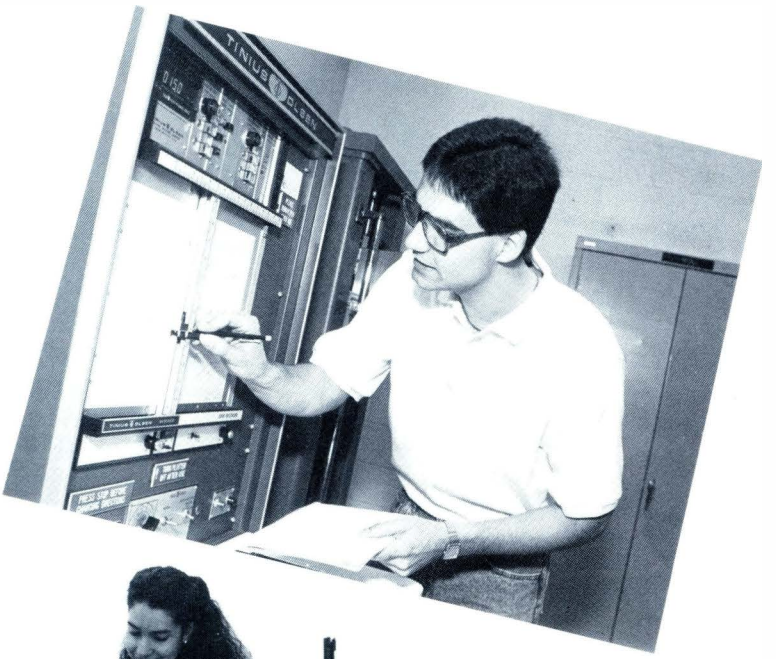
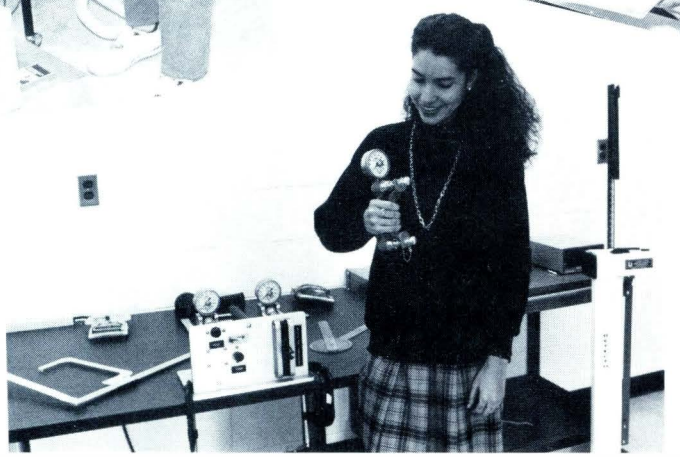
12-1991

9th Conference on Senior Engineering Design Projects

College of Engineering and Applied Sciences

Conference On
Senior Engineering Design Projects





Tuesday, December 10, 1991
Bernhard Center

College of
Engineering and
Applied Sciences

WESTERN
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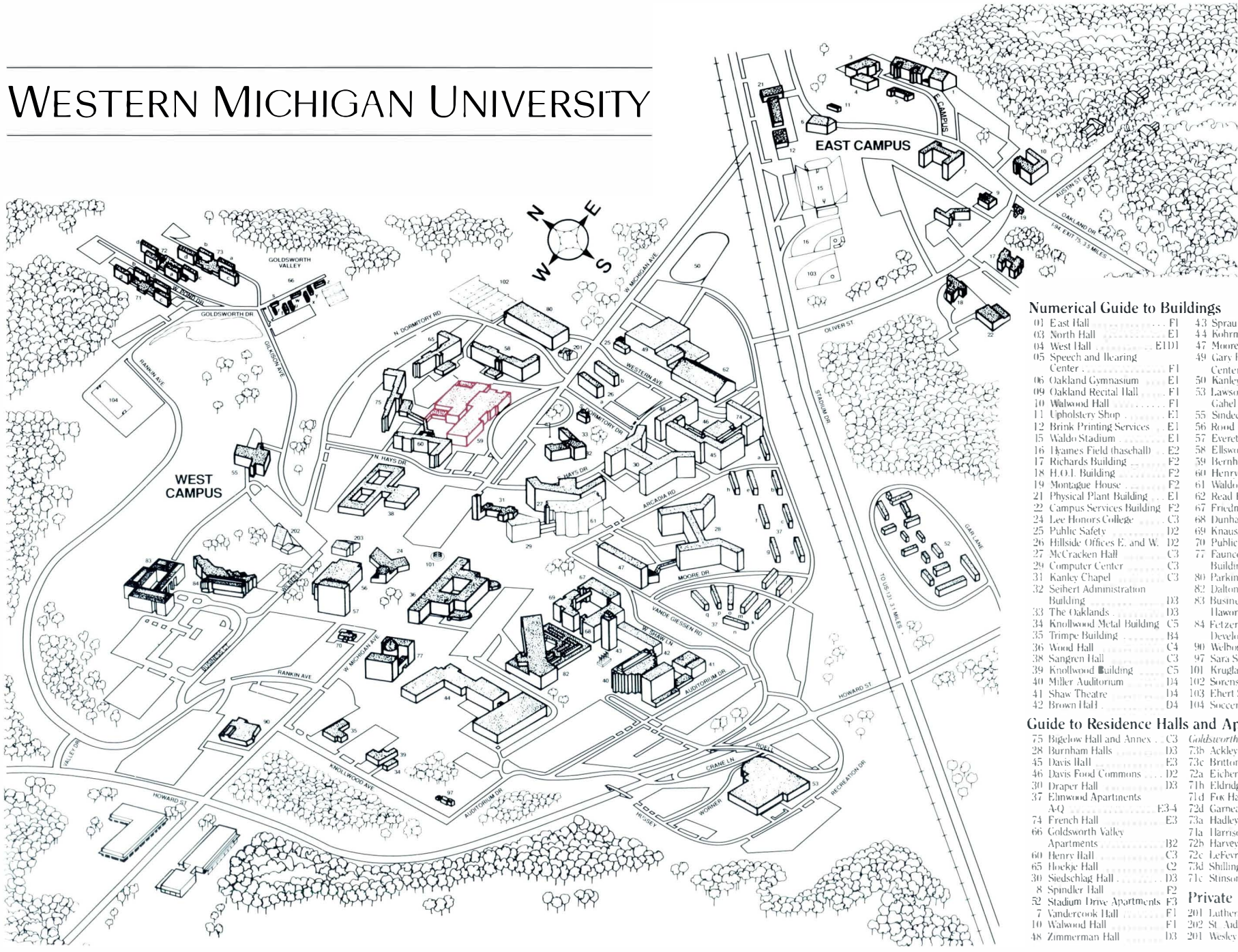
WESTERN MICHIGAN UNIVERSITY



Numerical Guide to Buildings

01	East Hall	F1
03	North Hall	E1
04	West Hall	E1D1
05	Speech and Hearing Center	F1
06	Oakland Gymnasium	E1
09	Oakland Recital Hall	F1
10	Walwood Hall	F1
11	Upholstery Shop	E1
12	Brink Printing Services	E1
15	Waldo Stadium	E1
16	Hyames Field (baseball)	E2
17	Richards Building	F2
18	H.O.I. Building	F2
19	Montague House	F2
21	Physical Plant Building	E1
22	Campus Services Building	F2
24	Lee Honors College	C3
25	Public Safety	D2
26	Hillside Offices E. and W.	D2
27	McCracken Hall	C3
29	Computer Center	C3
31	Kanley Chapel	C3
32	Seibert Administration Building	D3
33	The Oaklands	D3
34	Knollwood Metal Building	C5
35	Trimpe Building	B4
36	Wood Hall	C4
38	Sangren Hall	C3
39	Knollwood Building	C5
40	Miller Auditorium	D4
41	Shaw Theatre	D4
42	Brown Hall	D4
43	Sprau Tower	D4
44	Kohrman Hall	C4
47	Moore Hall	D3
49	Gary Physical Education Center	D2
50	Kanley Running Track	D2
53	Lawson Ice Arena and Gabel Natatorium	E5
55	Sindecuse Health Center	B3
56	Rood Hall	B4
57	Everett Tower	B3
58	Ellsworth Hall	C2
59	Bernhard Center	C3
60	Henry Hall	C3
61	Waldo Library	D3
62	Read Fieldhouse	E2
67	Friedmann Hall	D4
68	Dunbar Hall	D4
69	Knauss Hall	D4
70	Public Safety Annex	B4
77	Faunce Student Services Building	C4
80	Parking Structure	D2
82	Dalton Center	D4
83	Business Building, Haworth College of	A4
84	Fetzer Business Development Center	B4
90	Welborn Hall	B4
97	Sara Swickard Preschool	C5
101	Kruglak Sundial	C3
102	Sorensen Tennis Courts	C2
103	Ehert Softball Field	E2
104	Soccer Field	A3

Guide to Residence Halls and Apartments

75	Bigelow Hall and Annex	C3
28	Burnham Halls	D3
45	Davis Hall	E3
46	Davis Food Commons	D2
30	Draper Hall	D3
37	Elmwood Apartments A-Q	E3-4
74	French Hall	E3
66	Goldsworth Valley Apartments	B2
60	Henry Hall	C3
65	Hoekje Hall	C2
30	Siedschlag Hall	D3
8	Spindler Hall	F2
52	Stadium Drive Apartments	F3
7	Vandercook Hall	F1
10	Walwood Hall	F1
48	Zimmerman Hall	D3
	Goldsworth Valley Units 1, 2, 3:	
73b	Ackley Hall	A2
73c	Britton Hall	B2
72a	Eicher Hall	A2
71b	Eldridge Hall	A2
71d	Fox Hall	A2
72d	Garneau Hall	A2
73a	Hadley Hall	B2
71a	Harrison Hall	A2
72b	Harvey Hall	A2
72c	LeFevre Hall	A2
73d	Shilling Hall	A2
71c	Stinson Hall	A2

Private Property

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

Conference on Senior Engineering Design Projects

You are invited to attend the ninth Conference on Senior Engineering Design Projects. The conference will be held from 9 a.m. to 4:30 p.m. Tuesday, December 10, 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 at least one week before the conference.

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 is 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 Engineering	204	10 to 11	p. 3
Electrical and Computer Systems Engineering	210	9 to 1	p. 4
Engineering Technology	209	10:30 to 11:30	p. 6
Industrial Engineering	204	1 to 4:30	p. 7
Mechanical Engineering	208	9 to 4	p. 10
Paper Science and Engineering	204	9 to 9:30	p. 14

Coffee will be available in in the Faculty Lounge (across from 211) from 8:30 to 10:30. A **lunch** break is scheduled from noon to 1p.m.

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

AE = Aircraft Engineering
EE = Electrical and Computer Systems Engineering
ET = Engineering Technology
IE =Industrial Engineering
ME = Mechanical Engineering
PSE = Paper Science and Engineering

Time	Room	Dept.	Topic
9	210	EE	Infrared Scanning System
	208	ME	Redesign of Carpet Cleaner to Eliminate Corrosion
	204	PSE	The Effect of Internal Sizing on Paper Deterioration
9:30	210	EE	Low Explosive Limiter
	208	ME	Minimizing Warpage in Plastic Dome Housings
	204	PSE	Coloring on the Size Press Using Anionic Dyes
10	210	EE	Electronics Testing Package
	208	ME	Reduction of Kiln Emissions
10:30	210	EE	Dual-Input Regulated DC Power Supply
	209	ET	Computer-Aided Design Data Transfer Compatibility
	208	ME	Torque Requirements for Slider-Crank Mechanisms
11	210	EE	Digital Nutrient Pump Controller
	209	ET	Computer-Integrated Manufacturing of Plastics
	208	ME	Biohazard Label Applicator
11:30	210	EE	Automated Weather Station
	209	ET	Shredder for Plastic Containers
	208	ME	Spray Cooling and Jet-Impingement Cooling

LUNCH BREAK noon to 1 p.m.

1	210	EE	Controller for a Tankless Water Heater
	204	IE	Reduction of Set-Up Time in a Manufacturing Facility
	208	ME	Manufacturing a Plastic Intake Manifold
1:30	204	IE	Warehouse Consolidation of Shipping and Receiving
	208	ME	Alternative Portable Power
2	204	IE	Reducing Lead Time in a Manufacturing Operation
	208	ME	Solar-Powered Exhaust Fan
2:30	204	IE	Redesign of Plant Layout for CNC Machine
	208	ME	Low Volume, Multi-Product Clipper
3	204	IE	Reducing Patients' Waiting Time in an Emergency Room
	208	ME	The Quiet Cast Saw
3:30	204	IE	Processing of Surgical Components
	208	ME	Design Considerations for a Tankless Water Heater
4	204	IE	Prevention of Work-Related Wrist Injuries
	208	ME	Design of a Two-Stage Rotary Die System
4:30	204	IE	Warehouse Assembly and Delivery Process

AIRCRAFT ENGINEERING

Session Chair - Parviz Merati
Room 204

DESIGN STRATEGY FOR COMPRESSOR PERFORMANCE MAPPING

by Jeffrey C. Frost, Aaron T. Mosebach, and Brian J. Sawdon
Faculty Advisor: Curt Swanson
10 to 10:25 a.m., Room 204

A test strategy and procedure were developed to determine automatically the performance characteristics of a 12-stage, axial flow supercharger. Testing hardware and data acquisition computer software were designed to manage the procedure and record various operating parameters. Test data were used to develop a compressor performance map.

DESIGN EVALUATION OF AN IC ENGINE CRANKSHAFT

by John G. Mackoul
Faculty Advisor: Richard Hathaway
10:30 to 10:55 a.m., Room 204

Finite element analysis and holographic interferometry were used to evaluate the design of a reciprocating internal combustion engine crankshaft. Critical areas were identified based on design constraints of deflection and stress concentration. Stresses were analyzed at specific points in the operating cycle where maximum loads were found. The experimental method allowed for full-field, non-contact analysis of the deflection and stress. The finite element model was compared to experimental results.

PERFORMANCE ANALYSIS OF A RADIO-CONTROLLED CARGO AIRCRAFT

by Roger W. Glas
Faculty Advisor: Arthur Hoadley
11 to 11:25 a.m., Room 204

The performance of a radio-controlled cargo aircraft was analyzed, taking into account its mission requirements, which include a 200-ft. runway, a 1,200-sq.-in. planform area, and a K&B 0.61 cu. in. engine. The analysis included the takeoff, climb and acceleration, and landing performance of the airplane.

ELECTRICAL and COMPUTER SYSTEMS ENGINEERING

Session Chair - John Gesink
Room 210

INFRARED SCANNING SYSTEM

by Steven S. Gursin, Steven E. Kuznicki, and James B. Vogel
Sponsor: Dr. T. M. Srinivasan
Faculty Advisor: S. Hossein Mousavinezhad
9 to 9:25 a.m., Room 210

Some diseases in humans are indicated by abnormal internal body temperature. Internal body temperature can be inferred from the body's infrared radiation pattern. By detecting skin infrared radiation, a thermal cross-sectional image of a human body can be created. A biomedical measurement system was designed to collect and process infrared radiation from a patient. The design includes a data-acquisition board for an IBM-AT compatible personal computer. Software reconstruction algorithms were written in machine assembly and high-level languages. The system produces on the computer monitor a color-coded thermal image of the patient.

LOW EXPLOSIVE LIMITER

by Diane M. Doyle, Mark P. Kust, and Raed S. Shatara
Sponsors: James A. Gillis, Larry Davis, Jim Whitehead, and Daryl Eagle
Faculty Advisor: Dean R. Johnson
9:30 to 9:55 a.m., Room 210

An electronic device was designed and constructed for use with a specialized computer to monitor the concentration of combustible gas in the air. The device, called a Low Explosive Limiter (LEL), is used to determine the percent low explosive limit of hydrocarbon gas in the air and to signal unsafe working conditions. The LEL electronics consist of a low pass filter, a voltage regulator, current limiters, a gas sensor, an instrumentation amplifier, and a transconductance amplifier. The output of the LEL is an industry standard 4-20 mA current, with 4 mA indicating no gas present and 20 mA indicating the maximum safe concentration.

ELECTRONICS TESTING PACKAGE

by Tarek Y. Al-Dossary, Amisha Mehta, and Aaron Moskalik
Sponsors: Mickey Noonan and Chris Philips
Faculty Advisor: Ece Yaprak
10 to 10:25 a.m., Room 210

A system was designed and built to run diagnostics on an electronics package that drives a motor in a device produced by a local manufacturer. The electronics package can be inserted easily into a fixture interfaced with the testing system and a computer. The testing system detects and pinpoints defects in the electronics packages and provides a means of salvaging defective units.

DUAL-INPUT REGULATED DC POWER SUPPLY

by Daryl L. Carr and Michael L. Maynard
Sponsor: Paul M. Menig
Faculty Advisor: Joseph Kelemen
10:30 to 10:55 a.m., Room 210

Trucks made in North America use a 12-volt electrical system, and European trucks use a 24-volt system to supply power to the electronic control unit on semi-automatic transmissions. Through the use of integrated circuitry, a dual-input regulated DC power supply was designed to replace the separate 12- and 24-volt input power supplies on medium and heavy-duty trucks.

DIGITAL NUTRIENT PUMP CONTROLLER

by KaLon Ho
Sponsor: Kirk W. Northouse
Faculty Advisor: John Gesink
11 to 11:25 a.m., Room 210

A digital nutrient pump controller (DNPC) was designed and built to deliver liquid nutrients to hydroponic gardens. The controller allows the user to enter up to 48 different cycles over a 24-hour period. A given cycle will specify the exact time a pump is to be turned on and off. The unit has both a keypad input and a sensory input, used to detect a low fluid level in the nutrient tank. The DNPC can simultaneously control up to four pumps and has a multi-character, liquid crystal, alpha-numeric display. Cost of the unit is significantly less than that of comparable general-purpose controllers on the market.

AUTOMATED WEATHER STATION

by Jon Aristi, Steve Arnett, and Michael Stroud
Sponsors: Mike Neeley and Greg Fett
Faculty Advisor: Raghvendra Gejji
11:30 to 11:55 a.m., Room 210

A computerized weather broadcast station was designed to give pilots the information they need to land safely at small airports. Sensors measure barometric pressure, temperature, wind speed, and wind direction. A small computer stores and processes the information. An electronic speech system transforms the weather parameters stored in the computer into a spoken message. Further expansion of the system will transmit the message to the pilot via AM radio.

LUNCH BREAK NOON TO 1 P.M.

CONTROLLER FOR A TANKLESS WATER HEATER

by Mick S. Jones, Mike J. Smith, and James W. Troup
Sponsor: Kenneth Lutz
Faculty Advisor: Charles Davis, Jr.
1 to 1:25 p.m., Room 210

A microprocessor-based temperature controller was designed to replace an analog temperature controller for a water heater. The controller simultaneously monitors the outlet temperature and the set point temperature on the control dial. Based on these two quantities, the controller determines the power needed to heat the water to the set point temperature. The microprocessor-based controller improves performance over the analog controller in areas of temperature overshoot, ease of control program modification, and power line noise.

ENGINEERING TECHNOLOGY

Session Chair - Ralph Tanner
Room 209

COMPUTER-AIDED DESIGN DATA TRANSFER COMPATIBILITY

by Stephanie Davoust, Jody Kotecki, and Lisa Mickey
Faculty Advisor: Michael B. Atkins
10:30 to 10:55 a.m., Room 209

With the variety of CAD/CAM systems available today, companies need to be able to transfer data from one system to another. The most common way to transfer data is via a standard neutral file format, but 100 percent data transfer is not yet possible via these formats. A Data Transfer Reference Manual was written to document problems that occur when transferring data among CADKEY, AutoCAD, Schlumberger Bravo3, and other selected systems. The manual suggests ways to avoid or correct problems.

COMPUTER-INTEGRATED MANUFACTURING OF PLASTICS

by John Fischer, Michael Horn, and Eric Schulte
Sponsors: Peter Trzybinski and Rick Cederholm
Faculty Advisor: Paul Engelmann
11 to 11:25 a.m., Room 209

Today's plastics injection molding companies must increase productivity to remain competitive in a global market. Computer-integrated manufacturing (CIM) systems improve a company's ability to compete in changing markets. The project goal was to design and install a communications network linking an injection molding cell at the Applied Technology Center in Grand Rapids to multiple, off-site users, allowing study of injection molding process data. Participants include Western Michigan University, Ferris State University, Grand Rapids Community College, and a group of plastics-related companies.

SHREDDER FOR PLASTIC CONTAINERS

by Clifford J. Cartwright, Jeff Johnson, and Mark Stephenson
Faculty Advisor: Charles Woodward
11:30 to 11:55 a.m., Room 209

The move toward recyclable plastics has resulted in several new areas of concern, including storage for plastic containers until the trip to the recycling center. A device was designed and developed to reduce standard containers such as milk jugs or laundry detergent bottles to a more manageable volume. Operational limits were determined by examining similar products such as blenders, garbage disposals, and lawn waste shredders. Criteria were met by predicting and testing for the extreme conditions that the shredder might encounter. Upon completion of a 60-hour test cycle simulating two years' use, the shredder was evaluated as satisfactory.

INDUSTRIAL ENGINEERING

Session Chair: David M. Lyth
Room 204

REDUCTION OF SET-UP TIME IN A MANUFACTURING FACILITY

by Sean Hougham and Darrell Trent
Sponsors: Don Reynolds, Duane Gilger, and Michael Lathrop
Faculty Advisors: Liwana Bringelson and David M. Lyth
1 to 1:25 p.m., Room 204

A manufacturing facility wanted to decrease the time required to change the dies on their trim presses. The facility uses dies inside trim presses to trim excess material from die-cast parts. Critical path analysis was used to examine the internal steps required to change the dies and the external steps required before or after the changing of dies. New technology such as quick die change tooling was also explored, and recommendations were made.

WAREHOUSE CONSOLIDATION OF SHIPPING AND RECEIVING

by Scott D. MacArthur, Dale J. Semelbauer, and Timothy J. VanDusen
Sponsor: Mark L. Wallace
Faculty Advisors: Liwana Bringelson and David M. Lyth
1:30 to 1:55 p.m., Room 204

A warehouse was designed to consolidate shipping and receiving functions. Goals of the consolidation were to increase efficiency in material handling and to standardize procedures for storing and retrieving raw materials and finished products. There were two major constraints for design of the warehouse. The first was to make sure that at least 15 percent of the total storage space was available at any given time to allow for movement of stock within the warehouse. The other was to eliminate storage above 16 ft., for insurance purposes.

REDUCING LEAD TIME IN A MANUFACTURING OPERATION

by David Anderson, Rajeev Singh, and Carrie Weimer
Sponsor: Kal Kalkowski
Faculty Advisors: Liwana Bringelson and David M. Lyth
2 to 2:25 p.m., Room 204

A manufacturer of industrial reel mechanisms faced a dilemma because of excessive lead times for their heavy-duty reels. Lead time, the amount of time a customer waits to receive a product after the order is placed, ranged from three to four weeks. The basis of the problem was the haphazard organization of the stockroom, making impossible the timely location of necessary pieces. A separate work station/stockroom was created for the heavy-duty reels, achieving a smaller, more structured work area. The result was decreased lead time, elimination of unnecessary labor, and better use of floor space.

REDESIGN OF PLANT LAYOUT FOR CNC MACHINE

by Jean-Francois Blanc, James M. Monson, and Bret Pastryk
Sponsor: Ron Wolak
Faculty Advisors: Liwana Bringelson and David M. Lyth
2:30 to 2:55 p.m., Room 204

Study of a precision metal manufacturing plant revealed the need for an additional machining center for an industrial chuck product line. It was determined that a computerized numerically controlled (CNC) machine being used in a different area of the plant could be used effectively to increase production in the jaw and chuck area. That machine was replaced with a more versatile machine capable of producing a wider variety of products at a higher tolerance level. Plant layout was redesigned to optimize operator and machining capacities.

REDUCING PATIENTS' WAITING TIME IN AN EMERGENCY ROOM

by John D. Epple, Robert L. Mervich, and Dorian Mullens
Sponsors: Pamela S. Franssen, Mark Miersma, and Sally Berglin
Faculty Advisors: Liwana Bringelson and David M. Lyth
3 to 3:25 p.m., Room 204

A local hospital was interested in reducing patients' waiting time for emergency room treatment. The processes and procedures required before treatment were studied, and recommendations were made for improvements.

PROCESSING OF SURGICAL COMPONENTS

by Todd Barkovich, Americus Gill Jr., and Tim Luedecking
Sponsors: John MacDougal, Dan Green, and John Ryder
Faculty Advisors: Liwana Bringelson and David M. Lyth
3:30 to 3:55 p.m., Room 204

With the goal of producing an annual cost savings of $150,000 for a hospital, a feasibility study was performed with two purposes. First, the hospital wanted to identify disposable items which would be more economical to reuse; and second, sterile items currently purchased individually wrapped would be replaced with the same item ordered in bulk, packaged, and then sterilized by the hospital. Recommendations were presented about purchased products, work station layout, and inventory control procedures.

PREVENTION OF WORK-RELATED WRIST INJURIES

by Randy Bart, Jay Hiremath, and Christine Novack
Sponsor: Brenda Balfour
Faculty Advisors: Liwana Bringelson and David M. Lyth
4 to 4:25 p.m., Room 204

Several employees of a manufacturing facility have experienced work-related wrist injuries. Individual work methods and work stations were studied, and recommendations were made on ways to eliminate and prevent causes of wrist injuries.

WAREHOUSE ASSEMBLY AND DELIVERY PROCESS

by Brian Gunnett, Chad Johns, and Lonnie Pettit
Sponsors: Robert J. Berghuis, Edward W. Clark, and Robert J. Haldy
Faculty Advisors: Liwana Bringelson and David M. Lyth
4:30 to 4:55 p.m., Room 204

The assembly and delivery process of a business that manufactures auto-testing equipment was analyzed. A procedure was designed and tested to increase efficiency and effectiveness of the warehouse assembly and delivery process.

MECHANICAL ENGINEERING

Session Chair - Dennis J. VandenBrink
Room 208

REDESIGN OF CARPET CLEANER TO ELIMINATE CORROSION

by Paul Stevens
Sponsor: Dave Mannes
Faculty Advisor: Phil Guichelaar
9 to 9:25 a.m., Room 208

A serious corrosion problem has developed in the floor tool section of a carpet cleaner. The problem was identified as galvanic corrosion resulting from the use of dissimilar metals in contact with a water-based cleaning solution. Alternative designs were proposed to minimize the corrosion, and one was selected for field testing.

MINIMIZING WARPAGE IN PLASTIC DOME HOUSINGS

by Gregory M. Dalton
Sponsors: Craig Mitchell and Joseph Hoffman
Faculty Advisor: Jerry Hamelink
9:30 to 9:55 a.m., Room 208

Plastic dome housings were being produced with excessive warpage. It was determined that several processing factors could have an effect on warpage. It was not feasible to explore all of the more than 4,000 potential combinations and interactions of those factors. An experiment was designed to determine which factors are most likely to cause warpage and how they could be changed.

REDUCTION OF KILN EMISSIONS

by Len Strand
Sponsor: Russ Riggs
Faculty Advisor: Jerry Hamelink
10 to 10:25 a.m., Room 208

Several cement plants use electrostatic precipitators (ESPs) as the primary emission-reduction component for their kilns. Under normal operating conditions, the ESPs are very efficient. During periods of kiln shutdowns, kiln startups, and the transitional period to the roller mill by-pass mode, however, the efficiency of the ESPs decreases significantly. Alternative and supplementary technologies were researched, and system upgrade designs were recommended.

TORQUE REQUIREMENTS FOR SLIDER-CRANK MECHANISMS

by Paul J. Drogowski
Sponsor: David Kane
Faculty Advisor: Dennis J. VandenBrink
10:30 to 10:55 a.m., Room 208

In order to adapt the motor on an existing machine so that it can power a slider-crank mechanism, it was necessary to determine the torque requirements of the mechanism and the amount of time the torque must be applied for each period of motion. The slider-crank mechanism moves a 4,000-lb. die in a vertical plane. There are motion and dwell periods in its operating cycle. A mathematical representation was derived for the dynamic system. A math software package was used to solve the mathematical equations for the desired parameters. The values derived allowed selection of an appropriate servo-motor for the machine.

BIOHAZARD LABEL APPLICATOR

by Aaron Kolb and Donald Whyte
Sponsor: Larry Richert
Faculty Advisor: Dennis J. VandenBrink
11 to 11:25 a.m., Room 208

A "sharps counter" is a case used to dispose of medical waste such as needles and scalpel blades. Biohazard labels are placed manually on each side of the sharps counters, which come in many different sizes. A machine was designed to automate the process, improving productivity by decreasing the time needed to place the labels and ensuring straight, consistent placement.

SPRAY COOLING AND JET-IMPINGEMENT COOLING

by Rahimi L. Muhamud
Faculty Advisor: Christopher Cho
11:30 to 11:55 a.m., Room 208

Spray cooling and jet impingement are two methods of cooling used in industry to absorb heat from hot materials. Tests were conducted to compare the efficiencies of spray cooling and jet impingement cooling. Variable parameters such as nozzle diameters and flow rates were studied. A relationship was established between heat fluxes and hot surface temperatures.

LUNCH BREAK, NOON TO 1 P.M.

MECHANICAL ENGINEERING

Session Chair - Richard Schubert
Room 208

MANUFACTURING A PLASTIC INTAKE MANIFOLD

by Rick A. Borns and Robert K. Maxwell
Sponsor: James Warren
Faculty Advisors: Richard Schubert, Fred Sitkins
1 to 1:25 p.m., Room 208

Several closed-loop manufacturing modules were designed for use in producing a plastic automotive intake manifold formed by injection molding. Designs were submitted for review by members of an employee team and were revised as necessary. Finishing the manifolds involves installation of more than 20 brass inserts, which must be heated and pressed into the parts. Three fixtures were designed to allow automation of the finishing process.

ALTERNATIVE PORTABLE POWER

by Kevin Connell and Dru Watson
Faculty Advisors: Richard Schubert and Molly Williams
1:30 to 1:55 p.m., Room 208

A solar-powered portable fuel cell was designed to provide a safe, clean, and feasible source of electric power. A home base station uses solar photovoltaic cells to electrolyze water and store it as hydrogen and oxygen. The fuel cell recombines the stored hydrogen and oxygen to produce electricity.

SOLAR-POWERED EXHAUST FAN

by William Kauffman and James Klaas
Faculty Advisor: Richard Schubert
2 to 2:25 p.m., Room 208

A ventilation fan for a motor home was designed to use solar energy as the primary source of power. The fan is intended for use when the vehicle is stationary, primarily during non-daylight hours. Amorphous solar cells charge a battery to power the fan, an easily installed after-market package.

LOW VOLUME, MULTI-PRODUCT CLIPPER

by Jeffrey G. Dodge
Sponsor: Jeffrey Currier
Faculty Advisor: Jerry Hemmye
2:30 to 2:55 p.m., Room 208

A machine was designed to automatically place clips on various size plastic clothes hangers. The design includes rotating drum clip sorters, insertion cylinders, and a gravity-fed conveyor system.

THE QUIET CAST SAW

by Douglas A. Dubay
Sponsor: E. Dennis Lyne, MD
Faculty Advisor: Jerry Hemmye
3 to 3:25 p.m., Room 208

The saws used to remove orthopaedic casts are noisy. Much of the noise is generated by the drive motor. Separating the motor from the cutting head allowed motor noise to be muffled.

DESIGN CONSIDERATIONS FOR A TANKLESS WATER HEATER

by Greg Baksi and Alan Glanz
Sponsor: Kenneth E. Lutz
Faculty Advisor: Iskender Sahin
3:30 to 3:55 p.m., Room 208

Water heaters already in production meet normal residential demands, but the units must be connected in series to satisfy increased demand. The cost of developing a heating coil large enough for a more powerful single unit was analyzed. Components were selected to measure flow rate and pressure drops, and the possibility of casting instead of cast/machining the base of the unit was evaluated.

DESIGN OF A TWO-STAGE ROTARY DIE SYSTEM

by Jeffery J. Dowd and Drew A. Nielsen
Sponsor: Steven A. Goodrich
Faculty Advisor: Judah Ari-Gur
4 to 4:25 p.m., Room 208

A two-stage, short-life, rotary die system is needed for use with 32" web-litho presses that produce paperboard cartons for food packaging. The existing single-stage system cannot be adjusted independently between the creasing and cutting tools. Independent adjustment of the die tooling will enhance the overall quality of the cartons produced. A two-stage system was designed that uses the existing single-stage module system in conjunction with a redesigned die station and a newly designed creaser module.

PAPER SCIENCE AND ENGINEERING

Session Chair - Ellsworth Shriver
Room 204

THE EFFECT OF INTERNAL SIZING ON PAPER DETERIORATION

by Christer K. Eaton
Faculty Advisor: Raymond Janes
9 to 9:25 a.m., Room 204

Research indicates that, over time, papers produced under alkaline conditions undergo less loss in physical properties than those produced under acidic conditions. The research has not directly compared the same furnish sized with alkaline agents, sized with acidic agents, and unsized. Papers sized with the alkaline agents alkenyl succinic anhydride or alkyl ketene dimer have not been studied by accelerated aging tests for rate of deterioration. A comparison was made between the type of size and the paper deterioration using a TAPPI standard aging test involving moist heat. A correlation was obtained between sizing levels and aging rates.

COLORING ON THE SIZE PRESS USING ANIONIC DYES

by Clancy M. Redmond
Faculty Advisor: Nick G. Triantafillopoulos
9:30 to 9:55 a.m., Room 204

Surface coloring on the size press is an important process in the paper industry. Savings are experienced compared to conventional coating because of less down-time and dye usage. Anionic (negative charge) dyes yield the deepest and most permanent colors. The fiber furnish is also anionic, however, which repels the dye. A cationic (positive charge) electrolyte was mixed with the dye. To prevent the electrolyte from reacting with the dye, an ammonium inhibitor was also added. In solution, the ammonium inhibitor neutralized the electrolyte. As the inhibitor evaporates in drying, the electrolyte recovers its charge and acts as a bridge between dye and fiber.

Western Michigan University

Western Michigan University is one of the state's five graduate-intensive universities, and it is a Carnegie Doctoral I institution, the only one of its kind in the state. WMU's enrollment is approximately 27,000 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:

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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.

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The Digital Signal Processing Laboratory is equipped with 386-based workstations with hardware and software for real-time DSP applications. Research projects include alpha brain waves filter implementation, adaptive differential pulse code modulation, DSP schemes for fiber optic rotation sensor scale factor linearization, and digital processing of EMG signals.

The Energy Research Institute emphasizes renewable energies, principally in energy conservation and solar collector and photovoltaic design and applications. An operational solar energy system is demonstrated on site.

The Flight Test Laboratory is an airborne data-acquisition facility. It is equipped to flight-test customer aircraft components and aircraft.

The Fluid Mechanics Laboratory is equipped with the latest instrumentation for fluid measurement.

The Evaporative Pattern Casting Research Center develops information for design engineers and metal casting companies to allow them to take advantage of the cost-saving and productivity benefits of the process (also called "lost foam casting").

The Human Performance Institute is devoted to applied research, consultation, training, and the development of a resource and information data base in the areas of ergonomics, work analysis and design, human capabilities in the workplace, job safety, and product design.

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System and Software Engineering is a major research and design focus. Current research includes development of the mathematical foundations and a formal language for the rigorous specification, simulation, and analysis of discrete and combined discrete and continuous systems.

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 December 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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