Evaluating Materials and Body Structures for a Lightweight Vehicle

Ghassan Kridli, assistant professor of industrial and manufacturing systems engineering, and Ningyi Zhang, visiting researcher.

Ghassan Kridli drives his wife crazy when they pass an accident on the road. "As we pass by, I'll check out the passenger compartment to see what happened to it. Often if the front end of the vehicle has sustained major damage, but there is limited intrusion into the passenger compartment, I'll comment that it was a 'safe' accident. It makes my wife nuts."

Kridli, assistant professor of industrial and manufacturing systems engineering, has safety on his mind. Along with visiting researcher Ningyi Zhang and research assistant Huzefa Mamoola, he is currently testing the crashworthiness of the low-mass vehicle that is being developed for the Institute for Advanced Vehicle Systems.

"The current challenges for improving fuel efficiency and reducing emissions have led to either attempts to replace the traditionally used steels with lighter material alternatives, or research on techniques for improving the current steel structure to reduce the overall weight," says Kridli. "The main aim of body structure designers is to develop lightweight structures without compromising the integrity, structural characteristics, and time and cost of production."

"The objective of our project is to design the body structure in the low-mass vehicle, select materials, and perform structural analysis on the design," says Kridli. "We're in the last phase; we have designed the structure (space frame and unibody), we have selected different steel and aluminum alloys, and now we're looking at crashworthiness."

The unibody structure is a mass-efficient approach that has been used for lightweight vehicles in recent years. It consists of mostly stamped parts joined together using different joining techniques (like spot welding and mechanical fastening). "The unibody approach is a low-cost option in high-volume production," says Kridli. "But the cost of the required dies may not make sense with low production volumes. So we're also looking at the space frame structure."

The space frame structure takes advantage of available product forms. The structure comprises extruded or hydro-formed components, which can be designed to absorb more energy during a crash and to endure more concentrated loads than components made from stamped and welded sheets.

In evaluating materials for the vehicle, Kridli and his team assessed the mechanical behavior of steel and aluminum alloys under different loading conditions and speeds, and introduced these materials to the designed structures. "We evaluated the bending and torsional stiffness of each design," he says. "If you have low structural stiffness, for example, vibrations induced by road conditions, like potholes, can excite the body structure and reduce vehicle handling."

But evaluating structures and materials was the easy part, according to Kridli. The most challenging phase of the project has been making sure that the crashworthiness of the vehicle meets federal motor vehicle safety standards. "It's harder because of the different requirements and the speeds involved," says Kridli. "We're finding that aluminum can absorb a high amount of energy per unit weight during a crash, but its lower material stiffness compared to steel requires careful design considerations."

Kridli's team tests the vehicle for impact to the front, side, and rear, as well as roof crush, each at different velocities and using different barriers. All tests are done virtually, using the college's supercomputing laboratory. "We look at how each structure and each material responds to impact," he says. "Ideally, you want body structure components to absorb most of the crash energy, which otherwise would be transmitted to the occupants and result in major injury. The closer you get to the passenger compartment, the stronger you want your structure. When something doesn't meet federal crashworthy standards, we have to go back and see where the weakness is and modify the design as we go along."

Kridli has been working on the project for about a year and hopes to be finished within the next few months. "When we're done," he says, "we'll make recommendations as to how much savings we could achieve with our design, using certain materials. We're anticipating that although the materials themselves will be more expensive than traditional ones, if we use less weight we may be able to maintain our costs at the same level as a more traditional car."

Contact Dr. Kridli at gkridli@umich.edu or 313-593-5467

Rapid Prototyping: Producing Scale Models on a Budget

Ali Kamrani, associate professor, industrial and manufacturing systems engineering, in the Rapid Prototyping Lab

When engineering a vehicle, prototyping is critical. But it's usually prohibitively expensive.

That's where rapid prototyping and free-form fabrication become a valuable tool in design and engineering "Rapid prototyping is a relatively new field in engineering," says Ali Kamrani, associate professor of industrial and manufacturing systems engineering. "Its focus is to design and produce three-dimensional models directly from computer-aided design files." It also takes considerably less time than traditional prototyping. "To fabricate part of a full-scale model of an automobile front bumper would take roughly three weeks using rapid prototyping. Produced traditionally, it would take months," he says.

With the help of research assistants Saed Salhieh and Ricardo Gonzales, Kamrani is using rapid prototyping to create a scaled model of the low-mass vehicle currently being engineered within the Institute for Advanced Vehicle Systems. This is being done at the Rapid Prototyping Laboratory in the Engineering Complex on the University of Michigan-Dearborn Campus. "It's important for designers and engineers to be able to visualize what they're working on," says Kamrani. "Prototyping is a very effective tool that allows them to define and fix problems early in the process. It also reduces the overall design life cycle by allowing them to use the prototype for tooling, testing, and other downstream manufacturing activities, early in the process."

Kamrani defines three main steps in the rapid prototyping process: first, he creates a CAD model of the design, then he generates and prepares the prototyping files, and finally he develops a physical model.

"Our first objective was to study the surface model files created by the College for Creative Studies," says Kamrani. "We processed these files and then created a solid model and STL (stereolithography) files from the surface model. After preparing the STL files we were then able to create all of the physical models."

The models were developed on a laminated object manufacturing (LOM) machine, which created a scaled prototype of the lightweight vehicle out of laminated paper. "We also created a hollow version of the model," says Kamrani. "It's not easy to make a hollow part using this machine, but we were able to do it. This was important so that designers could see what the interior of the car would look like."

Now that they've completed the scaled prototype of the lightweight vehicle, Kamrani and his team are using the same rapid prototyping process to create an actual-size front bumper for the car. "Even though our LOM machine can build pretty large parts, we still have to build the bumper in three sections," says Kamrani. "The size is just so huge. So far we've done two of the pieces. It has taken us two weeks, and at a material cost of $3,000, it is still far less than conventional prototyping would cost. We probably won't prototype the entire actual-size car; it's not really feasible. Our main goals were to see how the interior and the exterior of the vehicle would look and study the feasibility of modular design. Although for the second objective, more data is necessary."

Kamrani is looking forward to the next stage of the project. "We're exploring rapid tooling," he says. "The low-volume goal for this vehicle may not require a vast amount of investment in tooling and facilities, so we're going to use prototyping machines to create tools for short production runs." Kamrani and his team are currently researching materials and collecting information to figure out the best approach to the next phase. "I'm really excited about the future," he says.

Contact Dr. Kamrani at kamkode@umich.edu or 313-593-5399

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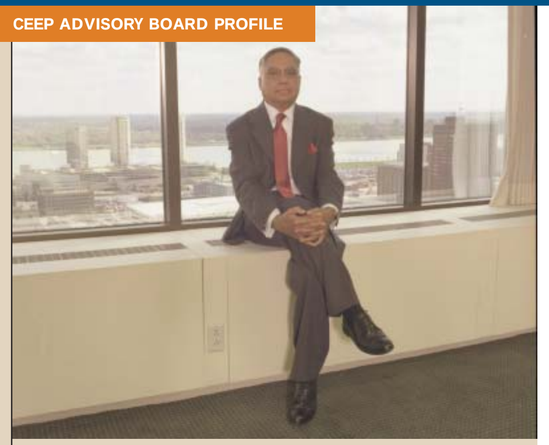

Nirmal Singh at DTE Energy in Detroit, Michigan

Nirmal Singh: Cultivating Engineering Education

Dr. Nirmal Singh is a master of understatement when he says: "My family is fond of education." His wife has three master's degrees; his son recently finished medical school and is now working on a master's degree in domestic violence studies; and his daughter is in the midst of pursuing a Ph.D. in public health. Singh himself has two bachelor's degrees, a master's degree, and a Ph.D. in electrical engineering. "Education," he says, "is the key to the future of this country."

However, Singh never expected to spend his adult life in this country helping to promote this message. Born in India and educated both there and in Britain, Singh initially came to Bridgeport, Connecticut, in 1969 to work for a year as an electrical engineer at General Electric. One year stretched to eight, after which he found himself moving to Michigan to work at Detroit Edison. "I belong here now," he says. "You appreciate this country when you've lived elsewhere."

While in Bridgeport, Singh also taught part-time at the University of Bridgeport, launching what has become a passion for bridging the gap between industry and education. This passion is what brought him to the College of Engineering and Computer Science (CECS) and the Center for Engineering Education and Practice (CEEP) advisory board. It also helped him to find his way to similar boards at Michigan Technological University and Purdue. "My aim," he says, "is to revive hands-on power engineering education in this nation, which has not been emphasized since World War II. Michigan alone has many more engineering schools than the entire country of Sweden. However, in the area of high-voltage power equipment it can really surpass the United States and at times make us look like a developing nation."

One of the things that attracted Singh to CECS is its strong alliance with industry and its practical approach to education. "One of the chief goals of a university should be to produce students who are relevant to what industry needs. CECS takes this seriously, more seriously than other schools in my experience. The college really listens to industry advisors and acts on our advice." During his tenure on CEEP's advisory board, Singh initiated a $150,000 grant from the DTE Energy Foundation to revamp the college's power electronics laboratory. "When the college came to me with several proposals, I carefully looked at which one would fit best for us. I worked with people at Detroit Edison (DTE Energy) to see what we might do. Then I talked with Bob Buckler (president and CEO of DTE Energy Distribution), and he made the case to the foundation."

At DTE, Singh works as a dielectric scientist, managing first-rate oil and paper laboratories unrivaled in the United States. He travels approximately 50,000 miles each year in the United States and to countries like France, Malaysia, and Venezuela, where he troubleshoots problems with electrical insulation for high-voltage paper-insulated cables. "If I can solve some unique problems, that's what I find exciting," he says. "People come to us from all over the country, all over the world, so the problems are never routine. They want to know how much life is left in a particular system, how should they best maintain it, should they replace it, that sort of thing. I like to solve something with a bit of a challenge."

When he's not traveling the globe for DTE or building bridges between the power industry and education, Singh plants trees. "I would say I've planted at least 37 evergreens in my yard," he says. "When we moved to Michigan, we missed all the trees in New England. So we tried to make Farmington Hills look a little bit more like Massachusetts. I think we succeeded."

Prechter Fellowship

Continued from page 1

and feel, including features that will help sell the car to a specific market. "One of the goals is to allow more reconfigurability," says Bhise. "For example, what if we make the seats so that they turn inwards to face each other? Then the vehicle can be more appealing to younger or Generation-Y-based buyers."

As specialists in ergonomics, Mamoola and Bhise ensure that the seats, dashboard controls, and foot pedals are created with the user in mind. For example, they test reach and range of vision to make sure the vehicle meets safety and comfort goals. "This vehicle could include new driver interface features" says Bhise, "so in order to design a new interior feature, we have to evaluate driver eye movements and how long the driver's eyes leave the road in order to read the displays. Then we break down visual tasks in manageable, one-second increments. If your eyes leave the road for more than 2.5 seconds, there's a danger of lane drift or slowing down."

Mamoola will work with Professor Bhise to provide CAD and engineering support. Assistance will also come from other faculty members and suppliers. CCS students will help create a three-dimensional mock-up of the vehicle interior.

"The goal of this project is not just to build a vehicle 30 percent lighter but to enrich the knowledge of students, faculty, and staff at IAVS," says Mamoola. "What's exciting about this project is that we look at the whole picture, not just the engineering aspect."

Introducing the New IAVS Advisory Board

Klaus Blickle

Klaus Blickle is chief technology officer of ASC Incorporated, leading technical and engineering efforts worldwide and heading ASC's Engineering Services, ASC Europe, and Triad Services Group. Blickle is responsible for the engineering component of ASC Vehicle Technologies.

Prior to joining ASC, Blickle served as president and CEO of Cosworth Technology, a division of VW/Audi, leading the company's growth effort and developing new projects. He was executive director of an Audi joint venture in China and completed a re-engineering project with Audi's Ingoldstadt operation.

Blickle has held strategic and operational positions with major companies in the aircraft and engineering industries. His goal at ASC is to combine superior engineering solutions with the company's capabilities in concept development and manufacturing to create a premier global company for specialty vehicle development.

A native of Germany, Blickle completed his undergraduate and post-graduate training at the University of Stuttgart, where he earned master of science and Ph.D. degrees. In addition to serving on the IAVS Board, Blickle is a member of the CECS Visiting Committee.

John Grace

John "Jack" Grace is vice president of engineering and technology at ArvinMeritor, Inc., a $7-billion global supplier of integrated systems, modules, and components for light vehicle, truck, and specialty original equipment manufacturers (OEMs). He is responsible for corporate engineering involving analytical mechanics, experimental mechanics, testing and materials engineering, as well as simulation and analysis.

Before the July 2000 merger of Arvin Inc. and Meritor Automotive Inc., Grace was vice president of systems and technology for Arvin Industries. Prior to joining Arvin in 1995, he worked with Calspan Corporation/Cornell Aeronautical Laboratory, where he began his career in 1963. Before being named vice president for product development in 1990, he held a number of technical assignments, ranging in fields from hydrodynamics and fluid dynamics to ballistic missile re-entry discrimination research. Grace's last operations assignment at Calspan was as head of the physical sciences department.

Grace holds a bachelor of science degree and a master of science degree in mechanical engineering from the University of Notre Dame. He also holds a master of science degree in applied mathematics from Cornell University and a master of business administration degree from the University of Dayton. He serves on the Visiting Committee at CECS.

James C. Masters

Jim Masters is president of the Electronics and Electrical Division for Lear Corporation, a position he was promoted to in February 2002. He is responsible for all facets of Lear's North American electronics and electrical business.

Prior to joining Lear, Masters worked in the transportation and aerospace industries. He joined Lear in 1994 as the manager of seat structures and analysis at Lear's Ford Division. He was promoted to director of advanced product development for the corporation in May 1995 and, through progressive advancements within the company, became president of Lear's Technology Division, a position he obtained in January 1999. Soon after, Masters accepted the role of president of global engineering for the Seat Systems Division, a position he assumed in March 2001.

Masters earned a bachelor of science degree in mechanical engineering from the University of California-Berkeley. He is a member of the Society of Automotive Engineers, the Engineering Society of Detroit, and the Visiting Committee and CEEP Advisory Board in the College of Engineering and Computer Science at UM-Dearborn. Masters is the current holder of 12 patents.

Masters resides in Farmington Hills, Michigan, with his wife Lynn and five children.

Robert C. Purcell, Jr.

Robert C. Purcell, Jr. is group director of planning and new business development for General Motors Corporation Powertrain Group. Purcell's responsibilities include global planning and customer interface activities, outside sales, technology planning, and advanced technology vehicles.

He began his GM career in 1982 at the Pontiac Motor Division after completing his master of business administration degree from Indiana University. Since that time, Purcell has been promoted to positions of increasing responsibility in GM finance and planning activities. In 1992, he was named director of business planning for GM's North American Operations, where he led development of the GM North America turnaround plan.

In 1994, Purcell was named executive director of the GM Electric Car Project, which successfully launched the world's first battery-powered electric vehicle in modern times, the GM EV1, in December 1996. That same year, Purcell was named executive director, GM Advanced Technology Vehicles, and in 1998 he became the executive director of GM Advanced Technology Vehicles Strategy and Operations. In 2001, Purcell was named to direct GM's North American Vehicle Innovation Programs.

Purcell has been a guest speaker at numerous industry technology forums and has served as guest lecturer at several universities.

Alex P. Ver

Alex P. Ver is vice president of advanced and manufacturing engineering at Ford Motor Company, a position he was appointed to in January 2000. His responsibilities include providing product program technology development and manufacturing methods and processes.

Ver joined Ford Motor Company in 1972 as a manufacturing process engineer in the Industrial and Chemical Products Division and subsequently held a series of engineering and production positions there until 1976. He then joined the Plastics, Paint, and Vinyl Division, where he was employed in several engineering positions from 1976 through 1984.

For the next five years, Ver held plant manager positions and served as manager of the quality office for the Transmission and Chassis Division. In 1989, he served as component program manager of the CD4E automatic transmission program and then became that program's plant and components manager.

In 1993, Ver was appointed manufacturing director of Alpha Simultaneous Engineering. In 1994, he was named director of manufacturing technology development, Manufacturing Operations-Ford Automotive Operations (FAO). He later served as director of the manufacturing business office until 1998, when he was appointed vehicle operations manager of FAO.

Ver holds a bachelor's degree in chemical engineering from Illinois Institute of Technology and a master's degree in manufacturing management from Ohio State University. He also serves on the CEEP Advisory Board at CECS.

CEEP-Funded Projects 2002

Applying Middleware to In-Vehicle Applications
Hasina Abdu, assistant professor of computer and information science, in collaboration with Dearborn Group and Ford Motor Company

Optimizing the Acoustics Package of Automotive Vehicles by Using Statistical Energy Analysis
John Cherng, professor of mechanical engineering, in collaboration with HP Pelzer Automotive Systems, Inc.

Reconfigurable Biomedical Diagnostics System
Ali ElKateeb, associate professor of electrical and computer engineering, in collaboration with MedMira Laboratories, Inc.

Fatigue Behavior of Aluminum Tailor-Welded Blanks
Ghassan Kridli, assistant professor of industrial and manufacturing systems engineering, and P. K. Mallick, professor of mechanical engineering, in collaboration with Ford Scientific Research Laboratory

Permanent Magnet Synchronous Motors for ZEV and LEV Powertrain Applications
Chris Mi, assistant professor of electrical and computer engineering, in collaboration with Delphi Automotive Systems and Ecostar Electrical Drive Systems

Influence of Microstructure on Corrosion Behavior of Magnesium Alloys
Pravansu Mohanty, assistant professor of mechanical engineering, and P. K. Mallick, professor of mechanical engineering, in collaboration with Ford Scientific Research Laboratory

Issues in Vehicle Networks: Fault-Tolerance, Message Time Constraints, Effective Network Throughput
Paul Richardson, assistant professor of electrical and computer engineering, in collaboration with U.S. Army-Tank Automotive Research and Development Center

NOx Trap Systems for Diesel and Lean Burn Engine Applications: Modeling and Simulations
Tariq Shamim, assistant professor of mechanical engineering, in collaboration with Oak Ridge National Laboratory

Power Semiconductor Devices for Automotive Applications
John Shen, assistant professor of electrical and computer engineering, in collaboration with Ford Motor Company, GM EMC Laboratory, and ON Semiconductor Corporation

Dynamic Normal Force Control for Vehicle Handling
Taehyun Shim, assistant professor of mechanical engineering, in collaboration with Ford Scientific Research Laboratory

Performance Analysis of Product Validation and Test Plans
Armen Zakarian, assistant professor of industrial and manufacturing systems engineering, in collaboration with General Motors Corporation

Modeling and Control of Automated Powershift Transmissions
Yi Zhang, associate professor of mechanical engineering, in collaboration with Ford Motor Company

IAVS Grants 2002/03

A Process Template for Systems Approach to Light Vehicle Design and Integration
Ali Kamrani, associate professor of industrial and manufacturing systems engineering

Optimization of Body Shape through Computation of Aerodynamic Forces on Low-Mass Vehicles
Inchul Kim, assistant professor of mechanical engineering

Suspension Design and Dynamic Analysis of Lightweight Vehicles
Taehyun Shim, assistant professor of mechanical engineering

Interior Design Project
College for Creative Studies and Vivek Bhise, professor of industrial and manufacturing systems engineering

the Catalyst

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The Catalyst is published for the alumni and friends of the University of Michigan-Dearborn College of Engineering and Computer Science. Send correspondence to the Editor, *The Catalyst*, 4901 Evergreen Road, Dearborn, MI 48128-1491.

2002 Senior Design Competition

Left: 2002 Senior Design Competition winners: Daniel Tylutki, Khushmeet Kaur, Alfred Piggott, Dawn Kieliszewski, and Professor John Cherng, mechanical engineering

Below: Demonstration of 2002 Senior Design Collegewide Award–Innovative Refrigerant Engine

The sixth annual College of Engineering and Computer Science Senior Design Competition took place in the spring.

The judges included Kaveh Abani (Compuware Corporation), Greg Burek (Ford Motor Company), John Fiaschetti (DaimlerChrysler Corporation), Sean O'Reilly (Ford Motor Company), Craig Peterson (Churchill Aerospace), and Bill Santos (Visteon).

DEPARTMENTAL AWARDS

Computer and Information Science
Project: Wood Badge Game Show
Advisor: Professor Bruce Maxim

Michael Agius, Denise George, Jennifer Nagy, and Timothy Smojver used a rapid prototyping model to create a series of software components that simulated a game show. The main program allowed players to enter information, load a game from a database, and play it. In addition to the main program and the database, the team created a game builder that facilitated the creation of a game in the database and a help system for the entire package.

Electrical and Computer Engineering
Project: Multi-Functional Alarm Control Center
Advisor: Professor Paul Richardson

Scott Cheney, Michael Erlich, Joseph Gasiewicz, Kevin Oliverio, and Joseph Stewart used assembly language and a Motorola HC11 micro-controller to combine various alarm systems into a single package that can be easily monitored and controlled from one interface. The software provides real-time displays of alarm events, trouble events, status events, and sensitivity levels from data produced by four sensors.

Industrial and Manufacturing Systems Engineering
Project: Methods Time Measurement Study of Order Picking/Spreading Process and Software Development/Design to Determine Powered Material Handling Vehicle Requirements
Advisors: Professors Swatantra Kachhal, Ghassan Kridli, and Elsayed Orady

Andrea Lechowicz conducted a manufacturing and technology management study on a picking and spreading process for Ford Motor Company. She then developed a model that reduced the amount of radio frequency scanning needed and replaced it with visuals in the form of boards and cards. The new process shaved more than twelve minutes from the procedure and saved one facility $112,000 annually. She also developed a tool to determine the powered material handling vehicles and cart requirements for a product distribution center.

Mechanical Engineering
Project: Innovative Refrigerant Engine
Advisor: Professor John Cherng

Khushmeet Kaur, Dawn Kieliszewski, Alfred Piggot, and Dan Tylutki designed and built a refrigerant engine that converted renewable, non-polluting radiant energy from the sun into useful mechanical energy. Their innovative design used only existing, low-cost materials and won them the senior design departmental award and the collegewide award in the competition.

A special thanks goes to Dave Hagen and the Hagen Family Foundation for his generous grant to support the Senior Design Competition. Some of this year's projects were funded through his donation.

Low-Mass Vehicle Project Moves Inside

The Institute for Advanced Vehicle Systems (IAVS) and the College for Creative Studies (CCS) have teamed up to design the interior of the low-mass vehicle. "The low-mass vehicle, which is the first focused project undertaken by IAVS, needs to have an interior that is compatible with the exterior of the low-mass vehicle that was designed at CCS in the summer of 2000," says Roger Shulze, director of IAVS.

Vivek Bhise, professor of industrial and manufacturing systems engineering, supervises the project and is being assisted by Huzefa Mamoola, this year's Prechter Fellow at the College of Engineering and Computer Science. Both Bhise and Mamoola bring to the project their expertise on ergonomics and human factors. Bhise is acting as advisor to the CCS class, while Mamoola works with the students to develop ergonomics for the vehicle. Ken Grant, an instructor from CCS, leads the class.

The project started this fall and will be accomplished in two phases. In the first phase, each student in the CCS senior interior design class will create an interior design for the IAVS low-mass vehicle, with special attention given to weight, cost, and investment. Designs must appeal to teens and buyers in their 20s. In December, one design will be chosen by a panel of industry experts to be the approved low-mass vehicle interior design.

Huzefa Mamoola, Prechter Fellow and a graduate student in engineering management, and Vivek Bhise, professor of industrial and manufacturing systems engineering

During the second phase, the creator of the winning design will be designated a Prechter Fellow and will work directly with Bhise and other college faculty, staff, and students to refine the design and make it conform to ergonomic standards.

"Ultimately, the most important goal of the interior design project is to help CCS faculty and students and UM-Dearborn faculty and students learn to work together for the integration of vehicle interior and exterior styling and engineering," says Shulze.

Lear, Johnson Controls, and Collins & Aikman are contributing to the project by hosting field trips to their facilities to show CCS students current trends in automotive interior design. IAVS and the American Plastics Council are financial co-sponsors of this project.

A Vision Continues

Continued from page 1

since allocated $22 million to construct a new engineering building to house IAVS.

"We have benefited tremendously from the wide-spread industry support we've received," says Roger Shulze, director of the Institute for Advanced Vehicle Systems. "But certainly our cornerstone has been the World Heritage Foundation."

The World Heritage Foundation has also been a prominent supporter of several other important projects that have greatly contributed to the growth and continued development of this school. The foundation was instrumental in advancing the construction of the Engineering Complex, which opened in 1997 and added 55,000 square feet of office, laboratory, and classroom space to a college that was in desperate need of additional room for its students and faculty.

The most recent foundation grant of $250,000 has created the Prechter Fellowships for New Manufacturing that are helping the college to educate students in advanced vehicle systems. The Prechter Fellowships have increased the educational and research opportunities for students in the area of "new manufacturing" especially as it relates to future global automotive markets. The fellowships will ultimately help the university to produce new leaders in automotive systems engineering and manufacturing.

"Our goal with the Prechter Fellowships is to produce not just technically astute engineers but well-rounded ones," says Shulze. "We select high-caliber students from the U.S. and Germany for the fellowships, and we help them focus not just on the technical nuts and bolts or on their own field of expertise but on an entire systems approach. The fellowships further Heinz Prechter's globalized team vision."

"Heinz was a great believer in providing educational opportunities to students from diverse backgrounds in order to foster international collaboration and to shape the future of the global automotive industry," adds Stephan Koller. "The Institute for Advanced Vehicle Systems and the Prechter Fellowships lead the way in his spirit."

Thus far, two students have been awarded Prechter Fellowships, and a third will be named in December 2002.

REEDF Funded Projects 2002

The Center for Engineering Education and Practice (CEEP) administers the Research Excellence and Economic Development Fund (REEDF). This program was established to stimulate economic growth and development in the state of Michigan through university research and technology transfer. Funded by the State of Michigan, the college's program is focused on research and education in the manufacturing area. It supports doctor of engineering in manufacturing students and provides seed funding for research on manufacturing topics.

AI-Based Strategic Decision Modeling for Custom-Oriented Company Management
Charu Chandra, assistant professor of industrial and manufacturing systems engineering

Ergonomic Evaluation and Design of Hand Tools Used in Manufacturing Industry
Mahmut Eksioglu, assistant professor of industrial and manufacturing systems engineering

Active Chatter Control of Metal Cutting Process
Carole Mei, assistant professor of mechanical engineering, and John Cherng, professor of mechanical engineering

Rapid Fabrication of Prototype/ Production Tooling by Spray Deposition Process, Phase II
Pravansu Mohanty, assistant professor of mechanical engineering

A New Data Mining and Knowledge Extraction Algorithms for Manufacturing Process Control
Armen Zakarian, assistant professor of industrial and manufacturing systems engineering, and Pravansu Mohanty, assistant professor of mechanical engineering

UNIVERSITY OF MICHIGAN-DEARBORN

Fall 2002

the Catalyst

News from the College of Engineering and Computer Science

CEEP
Center for Engineering Education and Practice

IAVS
Institute for Advanced Vehicle Systems

CLAMP
Center for Lightweight Automotive Materials and Processing

Welcome Friends

I am pleased to write the welcome letter for this edition of the Catalyst. Inside you will find a number of articles highlighting the activities of the Institute for Advanced Vehicle Systems (IAVS), which I joined as director in May of 2002. While these by no means represent all that is going on within IAVS, they do illustrate how we are moving to accomplish our objectives, which include ensuring the relevance of the curriculum, exploring systems issues, and advancing current technologies and methodologies. A "driving project," the creation of a low-mass vehicle, is the common focus of IAVS, and most of the articles relate directly to this project.

The interior design process for the low-mass vehicle is now under way in the College of Engineering and Computer Science and the College for Creative Studies (CCS). This collaboration continues the partnership that began with the design of the exterior of the vehicle. Those already familiar with IAVS will appreciate how natural it is for the IAVS team to study concurrently the aesthetics of interior design and the human factors engineering of interior design, just as it was natural to study the aesthetics of the exterior design concurrently with the study of reducing manufacturing cost.

In this issue, there is an interview with the latest World Heritage Fellow, Mr. Huzefa Mamoola. He and his faculty advisor, Professor Vivek Bhise, are working with the students at CCS in Detroit to create innovative, lightweight, and appealing vehicle interior designs. One of these will be chosen to be the interior design of the low-mass vehicle. We also introduce to you our new Board of Advisors for IAVS. The board comprises executives from some of the region's most successful companies. We will be relying on their advice and counsel to guide the institute through the next several years.

If you look carefully at this issue of the Catalyst, you will see hints of future areas of focus at the institute. In upcoming editions, we plan to feature some very new and exciting projects that are just beginning at IAVS. One of these is the study of the design, validation, and manufacture of reconfigurable vehicles.

To all of the current partners of the Institute for Advanced Vehicle Systems, I hope you will enjoy the articles in this edition of the Catalyst and conclude that the work of IAVS is valuable to your organization and to the college's mission of educating students. To those who knew very little about the institute before, it is my hope that you also will enjoy these articles and decide to find out more about IAVS.

Please feel free to contact my office if you have questions or suggestions. I look forward to hearing from you.

Roger C Shulze

Roger Shulze, IAVS Director

A Vision Continues

It has been more than a decade since the Prechter family's World Heritage Foundation began supporting programs in the College of Engineering and Computer Science at the University of Michigan-Dearborn. In that time, the foundation's funding has helped to vastly improve the college's infrastructure and programs and ultimately improve the educational experience for countless students. A recent grant from the foundation is ensuring that students will have even more opportunities to succeed.

Heinz and Waltraud "Wally" Prechter established the World Heritage Foundation in 1985 in the spirit of giving back to the community. The philanthropic foundation is dedicated to helping make a difference in the areas of health, education, welfare, arts and culture, and the community. In addition, the foundation fosters innovative public- and private-sector partnerships, entrepreneurial development, and German-American relations. Mrs. Prechter has served as president of the World Heritage Foundation since its inception. Stephan Koller, a longtime executive with Prechter Holdings, was recently named executive director of the foundation.

"The generous funding we have received over the years from the World Heritage Foundation was made possible by Heinz Prechter," says Subrata Sengupta, dean of the College of Engineering and Computer Science. "It was his enthusiasm that helped persuade the foundation to make these grants to us."

Dean Subrata Sengupta and Heinz Prechter

Heinz Prechter was an exceptional friend of the college who for years provided insight, guidance, and support that helped shape the direction of the school. His vision that the College of Engineering and Computer Science could become a leader in creating new types of systems for manufacturing and automotive industries became a reality with the creation of the Institute for Advanced Vehicle Systems (IAVS).

IAVS was established through a grant of $500,000 from the World Heritage Foundation and has since received substantial funding from a range of leading companies, organizations, and governmental sources, including General Motors, ArvinMeritor Fund, and the American Plastics Council. The State of Michigan has

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Prechter Fellowship

"This project has really opened up my eyes about how cars are designed from scratch," says Huzefa Mamoola, recipient of this year's Prechter Fellowship for New Manufacturing from the World Heritage Foundation. The award provides Mamoola with a year's tuition and living expenses as he works with the College for Creative Studies (CCS) to design the interior of a low-mass car directly from customer requirements. "I see a lot of talent at CCS; they look at how to build exactly what a customer wants. This assignment is showing me how projects like this start, how constraints are added, and how the vehicle starts to come together."

Already the recipient of a master's degree in automotive engineering from the University of Michigan-Dearborn, Mamoola is working on an additional master's degree in engineering management. Last year, he helped design the body structure of the low-mass vehicle on the CAD system in the College of Engineering and Computer Science. "His experience on last year's project in addition to his background in ergonomics made him a natural for this interior design project and for the Prechter Fellowship," says Dr. Vivek Bhise, professor of industrial and manufacturing systems engineering. Bhise is advising the CCS students during the first and second phases of the interior design project which is being conducted for the Institute for Advanced Vehicle Systems.

Some of the customer-driven requirements for the vehicle include reducing the mass of the car by 30 percent and making it appealing to customers in different markets. Students at CCS will design the vehicle's look

Huzefa Mamoola with assistant professor Ghassan Kridli

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The University of Michigan-Dearborn
College of Engineering and Computer Science
4901 Evergreen Road
Dearborn, MI 48128-1491

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