Wisconsin engineer. Volume 98, No. 4 September, 1994

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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WISCONSIN ENGINEER

VOLUME 98, NUMBER 4 SEPTEMBER, 1994

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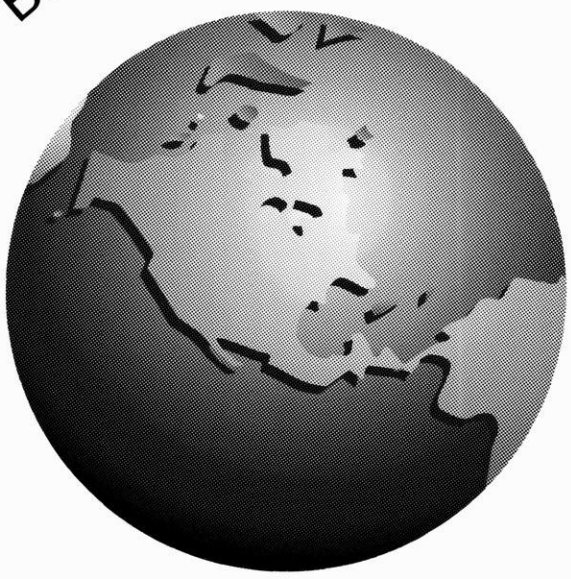

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WISCONSIN ENGINEER

Published by the Students of the University of Wisconsin-Madison

Features

The **Wisconsin Engineer** magazine, a charter member of the Engineering College Magazines Associated, is published by and for engineering students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering. All interested students have an equal opportunity to contribute to this publication.
Publisher's Representative: CASS Communications, 1800 Sherman Ave., Evanston, IL 60201-3715. Phone (312) 475-8800.
Publisher: Community Publications, McFarland, WI.
ECMA Chairperson: Donald C. Woolston, 1527 University Ave., Madison, WI 53706.
Correspondence: Wisconsin Engineer Magazine, Mechanical Engineering Building, 1513 University Ave., Madison, WI 53706. Phone (608) 262-3494. The **wisconsin engineer** is published four times yearly in November, January, March and August by the Wisconsin Engineering Journal Association. Subscription is $10 per year.

UP, UP, AND AWAY!

FLYING AS AN INTERNATIONAL COURIER

Have you ever wanted to visit a far away country? Are you looking for a little adventure? Are you still a poor university student? If you answered yes to these questions, then flying as a courier may be for you.

Spring Break in South America . . .

For my final spring break at UW-Madison, I decided to do something different. My dream was not to spend spring break in Florida or Texas, but to go further south, to Brazil. I have friends there, and the idea of spending my break on the beaches of southern Brazil sounded infinitely more exciting than the traditional spring break routine. The standard ticket price to Brazil of almost $1000 would normally make such a trip very extravagant, or in my case impossible. I needed a cheaper way, so I decided to try flying as a courier. I contacted a courier company which has flights to Rio de Janeiro and inquired about available flights neat the time of break. The agent listed off a few remaining dates, and the third one fit perfectly. In a few minutes I had made my reservation, and I was going to Brazil.

Have you ever wanted to visit a far away country? Are you looking for a little adventure? Are you still a poor university student?

Flying as a courier is somewhat different than flying as a regular passenger. First, couriers contract with a courier company itself and not an airline. This meant that I would not physically have my ticket until the day of the flight. At first this bothered me. However, this is standard practice in the courier industry, and it ensures that the courier will not simply refund the ticket and leave the courier company stuck. Since I needed a visa to travel to Brazil, the company gladly faxed me a copy of my ticket so that I could complete the required paperwork with the Brazilian consulate.

A few days before the trip, I reconfirmed the flight with the company and was told to meet an agent from the company at Miami International Airport a few hours before my flight. I traveled to the appointed meeting place, in front of the ticket counter for my airline to Brazil, and waited. Soon the agent arrived. He introduced himself, checked my passport to ensure that I had a visa, and asked me to wait while he prepared the paperwork with the airline. A few minutes later he gave me my boarding pass and my instructions for the return trip. I asked him "Is that it? Do I need to do anything else?" He responded, "No, have a good trip. If you do have any questions call the numbers listed on your contract."

I walked away and smiled as I looked at my boarding pass to Rio and the ticket stub, which showed the full price of the ticket of $1100, over $700

Photo from the Wisconsin Engineer archives

Perhaps this fall you could be sitting in a plane like this one on your way to a far-off destination, flying as a courier.

more than the price I had paid the company. I slept through most of my flight and was on the beach in Rio by noon the next day. Twelve days later, my return trip proceeded the same way.

What is a "courier"?

If thoughts of being a courier stir up images of James Bond and international espionage, I am sorry to say that you will be disappointed. What being a courier really means is the chance to travel to different cities around the world for very little money. Couriers work for various freight companies who ship packages and documents overnight to major business centers around the world.

The international courier market has developed rapidly in recent years as more and more global organizations need to quickly transport documents and packages. To fulfill this need, different courier companies offer shipping services using commercial airlines. These companies transport their material as checked baggage on regular flights because shipping parcels as excess baggage is cheaper and faster than sending them as air freight. But shipping items as baggage also means that they must be accompanied by a passenger ticket and naturally, a person. So, in exchange for his or her baggage allowance, a courier is given an airline ticket for a significant savings — generally over 50 percent of the ticket price and sometimes much cheaper.

Is it legal?

By now, you are probably asking yourself "Is this legal?" or "How do I know I'm not shipping drugs or something?" Yes, the whole process is quite legal and very safe for the courier. Each courier company has a contract with the airlines to ship material with couriers. The courier company and airlines inspect each shipment before it is sent, just as regular freight is inspected. They also must prepare and sign customs documents for the shipment. As a courier, you only carry a manifest for the company, and are not personally liable for the material shipped. Once you reach your destination, a representative from the company takes the material through customs. In many cases the courier never actually sees the parcel being shipped.

Where do couriers fly?

Couriers are only necessary on international flights. The domestic overnight package market is large enough for companies to have their own fleet of airplanes. Couriers fly to major cities on every continent (except Antarctica), and depart from several US gateways. The most common origin cities for courier flights are New York, Miami, Los Angeles and San Francisco. Flights also originate from Washington DC, Toronto, Houston and Chicago.

If thoughts of being a courier stir up images of James Bond and international espionage, I am sorry to say that you will be disappointed

Cost

The price a courier pays for a flight is a function of simple market economics. Courier companies establish an advance purchase price for each particular destination, which is often half of the cost of the usual economy ticket price. The companies then accept reservations for these flights. If the date of the flight approaches and they have not yet secured a courier for the flight, the ticket price begins to decrease, and sometimes quite drastically. Last minute trips to Europe for $100 round trip or South America for $150 round trip are even available during off peak travel times. Occasionally, a company will desperately need a courier at the last minute and will offer a free flight.

Becoming a courier

Since couriers work for courier companies and not airlines, calling a traditional travel agent or an airline directly will not yield any information about courier travel. Couriers arrange their flights in two general ways. They may contact a courier company directly, or they may arrange a flight through a courier broker. Two of the larger courier brokers are *Now Voyager* and *Discount Travel International* both in New York City. First time couriers often find the second method easier. An invaluable source of courier information is the *International Association of Air Travel Couriers*. This organization publishes a newsletter and bulletin of current air courier possibilities. It is the most complete single source of information available to potential couriers.

Currently, most courier flights originate from either coast. For people living in the Midwest this means the added expense of a domestic flight to coastal cities. However, this additional cost is often offset by a significantly cheaper international ticket. Hopefully, some further investigation into courier travel will lead you to a courier flight of your own and the chance to travel to a distant country relatively inexpensively.

Author Bio:
Joe Skidmore has just graduated with a degree in Civil and Environmental Engineering. He now calls Austin, TX home, but hopes to return to Brazil soon.

Major Courier Destinations:

Europe	**Asia**
Amsterdam	Tokyo
London	Seoul
Paris	Hong Kong
Rome	Jakarta
Milan	Sydney
Madrid	Melbourne
Frankfurt	Taipei
Copenhagen	Auckland
Hamburg	Kuala Lumpur
Brussels	Jerusalem
Central America and Caribbean	**South America**
Mexico City	Caracas
Guatemala City	Rio de Janeiro
San Juan	Sao Paulo
	Montevideo
Africa	Buenos Aires
Cape Town	Lima
Nairobi	Quito
Cairo	

A Taste of Things to Come

Hands-on Engineering for Freshmen

For many students the focus of their first year or two of college is to narrow down their interests in order to select a major. Some begin with an idea of career options, while others come with a clean slate that is ready to be filled with new possibilities. Among the crowd there are a number of admirable people who have a clear vision of what they want to study. They begin freshman year with classes oriented towards their chosen curriculum. Unfortunately, many of these students tend to drop out of their majors before they really get a taste of what it involves. In the College of Engineering the drop-out rate is particularly high for women and minority, reaching as high as 75 percent. Many students feel that the engineering curriculum needs to be altered, since they do not take classes in their actual engineering department until their sophomore or junior year.

In the May 1994 issue of Wisconsin Engineer we featured an article about some of the professors on the engineering campus who have participated in a 'Teaching Improvement Program'. Participating professors Michael Corradini, John Webster, Richard Marleau, John Mitchell, Pat Farrell, John Malkus and John Moskwa have now come together to develop a new course specifically intended for freshmen and sophomores which will address these problems. The objective of the course is to offer more hands-on experience in engineering labs, projects and on computers. By exposing freshmen and sophomores to real engineering early in their curriculum, the professors hope to help retain some of those potential engineers that are slipping through the cracks and dropping out of their intended majors.

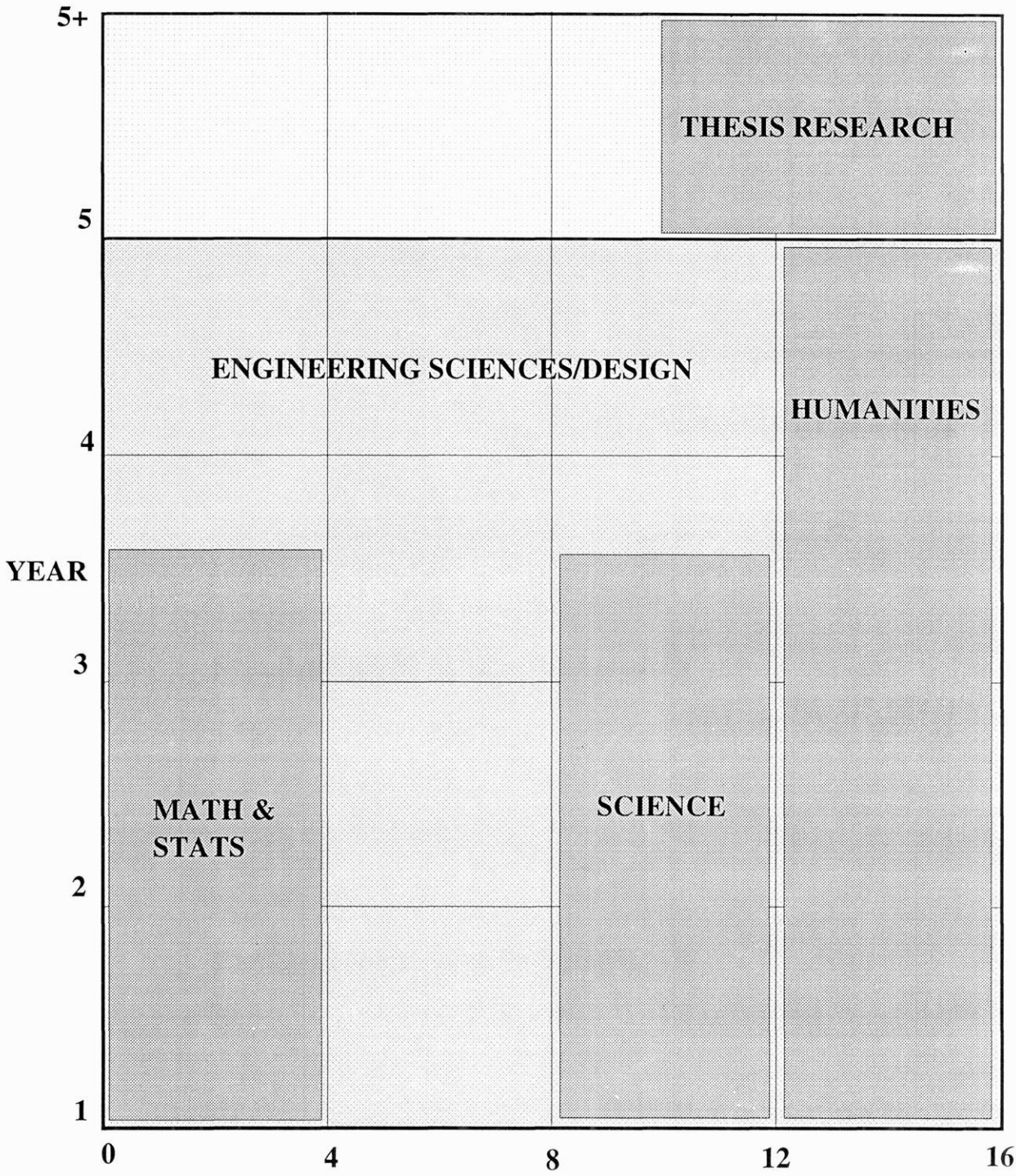
The objective of the course is to offer more hands on experience in engineering labs, projects and on computers

The course will be offered to freshmen and sophomores as a two semester sequence in the fall of 1994. In the timetable the course is titled Special Topics: Introduction to Engineering 1. It is listed under different departments such as: Mechanical Engineering 602, Electrical and Computer Engineering 379 and Nuclear Engineering 602 (Lecture 2.) Each semester of the class will be offered for two credits. Both courses will be project oriented. Students in the first semester will start with projects that will be challenging and interesting, while remaining at a skill level intended for freshmen. The second semester will be a continuation of the first, with more variety incorporated into the projects. As the students start to learn physics and math in their other course work, they will start applying these skills to their projects.

...one of the possible projects will be building a self powered device, such as a smoke detector, that will not need batteries

Michael Corradini, a Nuclear Engineering and Engineering Physics professor who will be teaching part of the course says that one of the possible projects will be "building a self-powered device, such as a smoke detector, that will not need batteries." Professor Pat Farrell indicated that in addition to the projects the students may also learn about the ethics, marketing and 'constraints' of engineering. These students will be able to learn a great deal about engineering and how the courses they take will apply to the real world. Without such an opportunity, many students begin to feel overwhelmed by all the math and sciences that they are taking as freshmen and sophomores. When students start out, they tend to wonder,"How will this course benefit me and why should I learn the material?" This dilemma can develop into disinterest and may eventually cause students to drop out of a major. Introduction to Engineering 1 will provide aspiring engineers with enough knowledge to develop an interest in and an understanding of engineering which normally would not come until a student reaches the junior or senior level.

AUTHOR BIO:
Caroline Curley is a senior studying English and Elementary Education. This summer she had many adventures teaching a kindergarten class filled with energetic five year olds.



PROPOSED STRUCTURE FOR NEEP CURRICULA

Remember when you were a Pre-engineer and had never taken an engineering class? Thanks to the new Pre-engineering curricula, freshman and sophmores will get a taste of engineering while they fulfill their breadth requirements.

Research with Recyclables

With such a large emphasis on recycling in every facet of today's society, it is no wonder that engineers are getting into the scene. Mechanical Engineering Professor Tim Osswald was recently awarded funding for his project entitled "Mixing and Processability of Thermoplastic-Natural Fiber Composites Using Materials Recovered from Municipal Solid Wastes." Now that is a title that would be tough to fit on the spine of a book! Working in conjunction with American Wood Fibers, and Engineered Plastics Corporation, Osswald, assisted by a graduate student and three undergraduates, will be conducting research to find ways to reuse the recyclable High Density Polyethylene (HDPE) recovered from everyday products such as milk jugs, laundry detergent containers, and wood fiber recovered from recycled paper products. The HDPE used in the research will be ground up into small pellets which will then be mixed with the wood fiber to create a cheaper composite material.

Though it sounds simple, the project is not as easy as throwing the recycled materials together, since the effects of mixing wood fiber and recycled HDPE have never been studied. The two materials will be placed together inside a hopper and an extrusion machine will mix them. There are many different types of extrusion machines, but all operate on the same basic principle. First, a hopper is filled with the material to be extruded in pelletized form. The pellets are then gravity fed into the barrel of the machine. Once inside the barrel, the material is melted through the use of high internal pressure created by the screw and heating bands on the outside of the barrel. After being mixed inside the extruder, the composite material will be extruded in a continuous fashion like a big, long piece of spaghetti. Once the newly created composite material has cooled, it will be ground back into pellets which can then be used just like new pellets.

You could get up in the morning and pour your milk out of a jug that was made from the detergent bottle you threw out last month along with bits of your neighbors' newspapers

The intent of the research group is to create composite pellets which will be useful in blow molding processes as well as in extrusion type applications. However, it is not yet known what percentage of wood fiber additive can be used to still allow the material to be blow molded. Wood fiber additive improves material properties desirable in extrusion type applications, but makes the material less ductile and therefore difficult to blow mold. Rich Theriault, a graduate student working on the project says that currently "...the group is blending the wood flour and HDPE at various percentages by volume. Eventually the group will test the material to find the optimum percentage that maximizes certain mechanical characteristics of the composite."

Blow molding is the method used to produce hollow items such as milk jugs, soda bottles, garbage cans, and even gas tanks for automobiles. The possibilities are intriguing, though not necessarily appetizing. For instance, you could get up in the morning and pour the last bit of milk out of jug made from the detergent bottle you threw out last month along with bits of your neighbors newspaper. You could then

take the empty milk jug and throw it in a garbage can made entirely from yesterdays garbage. By the time you got around to drinking a soda at lunch time, out of a container made partly from that ridiculous parking ticket you tossed, your morning garbage could be on the way to a landfill in a truck with a gas tank made from recycled materials as well.

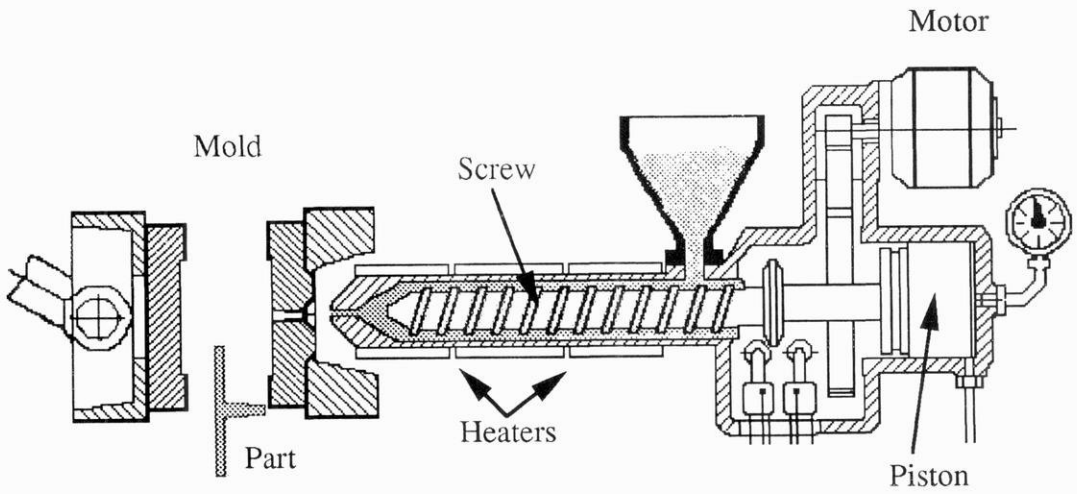
There are many unknowns which need to be studied, such as the flowability of the composite inside the mold. Flowability is also sometimes referred to as processability. Processability is important to varying degrees depending on the type of mold being used. If the mold is intricate, and the polymer or composite material does not have good flow characteristics, it will not fill the mold properly. Fortunately for researchers, the flowability of a material within a mold can be measured using a spiral mold. A spiral mold is a special spiral shaped mold used exclusively to study the flow of polymers. The farther along the spiral path a material flows for specific processing conditions, the better the flow characteristics of the material.

Keeping used polymers and recycled paper out of the landfills and putting recycled goods on the shelf will keep the earth a little greener

Since the wood fiber derived from recycled paper is less expensive than the polymer, about three cents versus a dollar per pound, the higher the volume percentage of wood fiber that can be added, the better. Adding wood flour affects the material properties significantly, so different volume percentages and their effects on material properties will be studied. Since such a composite material is unique, ASTM (American Society for Testing and Materials) testing will also need to be performed before applications for the new composites can be determined.

Using recycled polymer pellets costs less than using new material, and adding wood fiber will reduce the weight of the product as well as the cost. Keeping used polymers and recycled paper out of the landfills and putting recycled goods on the shelf will keep the earth a little greener. Such research is truly valuable to both the environment and society.

AUTHOR BIO:
R.J. Elsing is a senior in Mechanical Engineering. He is one of the undergraduate students currently involved in this project.



Students are experimenting with ways to turn old HDPE plastic into new plastic that can be used to make soda bottles, garbage cans, even gas tanks. These are the parts of the injection molding machine whcih helps the researchers concoct the plastic recipe.

Concurrent Education?

Engineering Professor Takes New Approach to Teaching

Imagine a class where the students are teachers, the professor is a student and grades are not the bottom line. Could it be possible? Yes. This is not the scenario of some television sitcom — it is the real thing in Industrial Engineering 691: Advanced Computer Aided Manufacturing.

IE 691 is a graduate level course facilitated by Professor Raj Veeramani. Veeramani takes a unique approach to teaching this course, one he calls *concurrent education*, that derives its inspiration from the concurrent engineering philosophy.

Veeramani explains that the traditional process of product development is sequential,
"Design gets a product concept from marketing; they design it and throw it over the wall to manufacturing; manufacturing determines how the product will be manufactured and then throws it over the wall to production and so on."

Many difficulties associated are with this type of approach to product development. "There are communication gaps", Veeramani explains, "that make it very difficult to fully gage the implications of decisions made at a stage in downstream activities". A lot of time and money is often spent on fixing 'unanticipated' problems.

Under a concurrent engineering approach, a product is developed collectively by a design team with representatives from a variety of functional areas such as marketing, design, manufacturing, and production. Using a cross-functional team allows all facets of the product life cycle, from functional requirements to serviceability issues, to be taken into account at the design phase. This approach enables a company to introduce a higher quality and cost competitive product in a shorter time span.

According to Veeramani, the same thing that happens in the traditional manufacturing setting has been happening in our education system. "What we often do at the University is teach students what we think they need to know and then throw them over the wall to industry. A lot of time and effort often goes into training students when they reach industry," Veeramani points out. This is the same problem that manufacturing firms had with the sequential product development approach.

Imagine a class where the students are teachers, the professor is a student and grades are not the bottom line.

Veeramani recognized these similarities and thought "Why not take the concepts of concurrent engineering and apply them to education?" The result is something he calls concurrent education.

Veeramani explains, "It is not that we are teaching the students the wrong things; rather we need to provide students [with] more opportunities to address manufacturing engineering problems in their entirety and also to gain insights into the *art* of manufacturing that one learns only from years of experience." To provide students a comprehensive learning experience, Veeramani's course embodies three vital ingredients — cooperative learning, hands-on experience, and industry based education.

In most classes it is automatically assumed that the instructor is the expert and everyone else is there to learn. But in IE 691, which consists mostly of engineers returning from industry to school, the students have diverse backgrounds and industry experiences. Veeramani strongly believes that by creating an environment for cooperative and team-based learning, everyone can learn from each other in a collaborative effort rather than looking to him as the sole source of knowledge in the classroom. By running the class using a team approach where students are

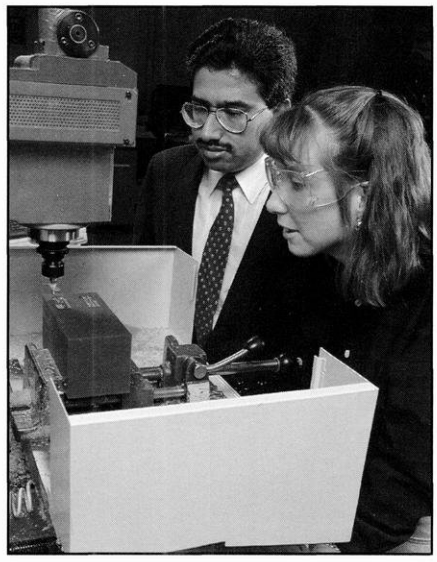


photo courtesy of Engineering Publications

Professor Veeramani assist a concurrent engineering student working on a piece at a vertical milling machine.

empowered and responsible for learning and teaching the material, "Students get the opportunity to take advantage of all the expertise in the room," Veeramani says.

Veeramani further suggests that more learning can take place by having a team of educators (students, the instructor, and industry representatives) rather than just one instructor. During a typical class period, a team of four students is responsible for teaching the theory or computer-aided tool under discussion. "So in essence," Veeramani says, "four people in the class have become experts in that topic instead of just one, and during the class period, these four students help others to also master the material."

On the first day of class, the 15 students enrolled in the course spend time deciding what they want to learn during the semester within the realm of computer aided manufacturing. They decide how they wanted to learn the material, what computer-aided tools they want to use, and also how they are going to measure the level of learning.

The result of this discussion is the formulation of four course modules focusing on different manufacturing techniques such as EDM, casting, tool and die design and manufacture, and sheet metal fabrication.

Each module begins with a discussion of the theory and principles underlying the topic and involves team presentations of the material to the rest of the class. These discussions are combined with hands-on sessions on state-of-the-art computer-aided tools pertinent to that form of manufacturing. The classroom meetings are followed by a visit to a related industry, where students learn first-hand about how a company uses that particular manufacturing process, and also gain insight into all the decisions that need to be made to transform a customer request, often in the form of a sketch or a blueprint, into a finished product. Finally, the students return to class with a "real" project assigned to them by the company and solve it using the theory, computer-aided tools, and practical insights that they have learned in the module.

For example, during the course module on casting, the students learned in the classroom how to use ProEngineer for building Computer Aided Design models of castings and to perform solidification analysis using the SWIFT software package. Students then visited the UW Foundry and actually made parts using a sand casting technique. Subsequently, they toured a local foundry where company personnel demonstrated all aspects of making a part from the time the company receives a customer's call for a quote to the actual production of the part. They were then given a blueprint by the foundry president and asked to submit a quote for manufacturing the part. To perform this assignment, the students used the computer-aided tools for modeling and analysis that they had learned earlier in the module, and developed a cost proposal that was then submitted to the company. Their results are currently being evaluated by the company.

"Four people in the class have become experts in that topic instead of just one, and during that class period, these four students help others to also master the material." - Professor Raj Veeramani

Veeramani feels that it is important to include all the steps from design through production when learning about a specific method of manufacturing. "Very often a course will focus on one small aspect of manufacturing and ignore everything else with the hope that students will pick up the other pieces from other classes and somehow put them together in their heads—it's just not happening," Veeramani says.

In general, students find this method of learning very valuable. For Russ Beard, a returning engineer, it is refreshing to have students, instead of a professor teach the class. "You know what level other students are on, sometimes when a professor has been teaching for a long time he or she forgets that this is the first time we have seen the material," Beard comments.

Steven Sutiono, a graduate student without industry experience finds the class meaningful as well. "The industry visits are helpful because I don't have any experience in industry and this way I can see what it is like," he says.

While the value of the concurrent education approach appears clear to students, the companies that participate in this education process also derive some benefits. Through the projects the students conduct in each module, companies can gain insight into the value of using various computer-aided tools and analysis techniques that can make them more competitive in today's global marketplace. Veeramani adds, "The concurrent education approach offers a win-win proposition to all the participants — students, faculty, and industry."

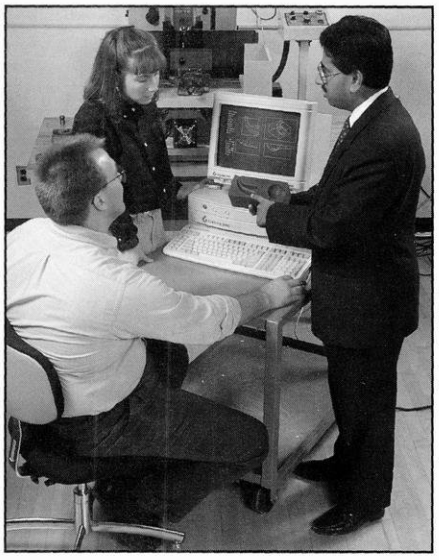


photo courtesy of Engineering Publications

Professor Veeramani and two students discuss the dimensions of a part with the help of Computer Aided Design.

AUTHOR BIO:
After graduating in May, Leslie is planning to tour Europe with her sister. After that, she's going to get a job in the big city of Chicago and become famous doing something.

Parametric 3 - D Modeling

Designer and Computer Working Together

With the power of computers increasing every day, computers used by companies for the design and manufacturing of products are in high demand. In order to increase profits companies are trying to cut down on concept-to-production time. Today, high-tech parametric 3-dimensional modeling programs are leading the way to faster and more efficient prototype periods for products. Both at UW-Madison and in industry, Professor Rajit Gadh has seen the impact that parametric modeling programs are having on manufacturing techniques. Gadh, who holds a Ph.D. in computer integrated concurrent design from Carnegie Mellon University, has been at the UW-Madison Department of Mechanical Engineering for two years. Today he is helping to lead the way to new ideas in the realm of industrial manufacturing.

Going back 40 years or so, companies were doing design and drafting on drawing boards. Twenty years ago designers and draftspersons were drawing on 2-dimensional computer programs such as AutoCad. In the early 1980's a new prospect in design software began to take shape - - 3-D solids modeling and parametric CAD (computer assisted design). According to Gadh this idea makes perfect sense. "The principal advantage of the solid modeling over the 2-D drafting is that real objects are three dimensional," he says. Gadh points out that is is only logical to design products on the computer as they will be produced on the line. "This will allow the designers and manufacturers to look at the parts they are designing and see on the computer how the various parts and assembly will fit together. Many of the [part's] visual things can be captured even before you send the part to be manufactured," Gadh says.

Although the difference between 2-D drafting programs and 3-D modeling programs may be obvious, the difference between 3-D modeling and 3-D parametric modeling software may not.

The idea behind computer integrated concurrent design is for the computer and designer to interact with each other to determine the best course of action in the product design

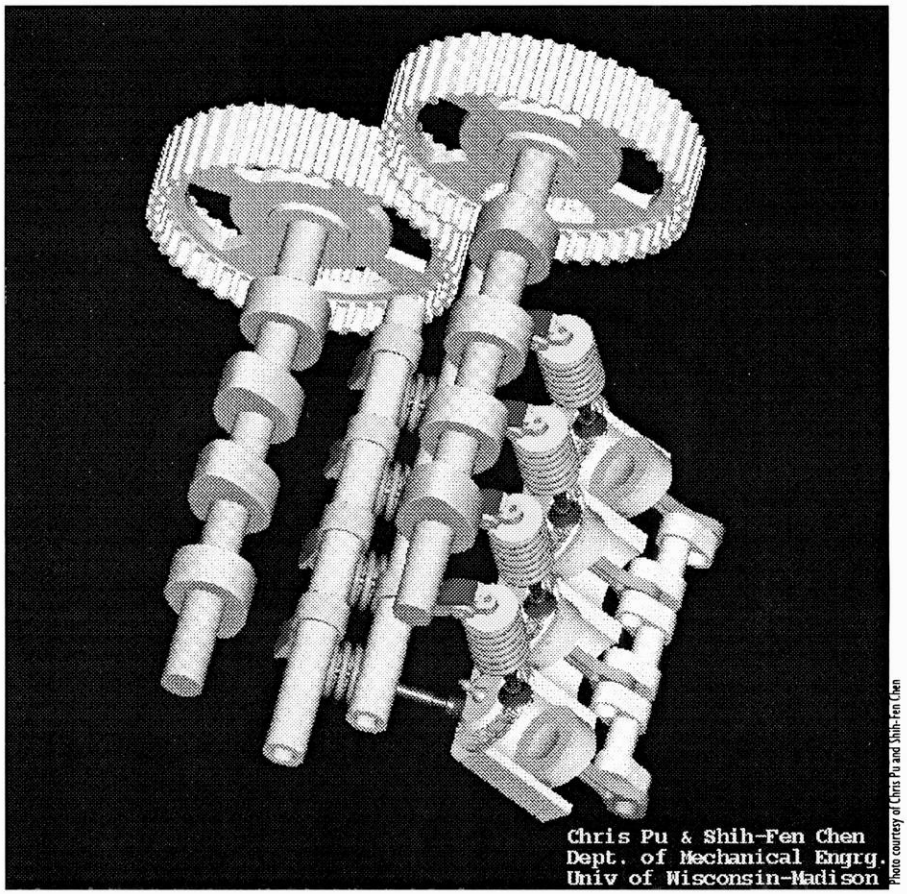
What makes parametric modeling different is that the designer works with the computer and creates the object in terms of the parameters for the object's entities. For example, if an object has 20 2mm in diameter holes and the designer decides to enlarge the holes to 2.2mm, he or she can simply change the hole diameter parameter for the entity type (the hole). This differs from regular 3-D solids programs where the designer would have to change each hole individually. After these parametric changes have occurred, "The computer will figure out how to update the solid model," says Gadh. 3-D modeling will also allow a designer to move and rotate an object around on the screen, allowing for details to be seen directly. This has only been possible on 2-D programs using various sectional and auxiliary view drawings.

Another benefit that stems from the idea of integrated computer concurrent design is computers assisting designers to present design mishaps. With Pro/ENGINEER, a 3-D parametric modeling program used at UW-Madison, a computer can warn a designer if certain elements on the piece being drawn may cause future problems. For instance, if two holes drawn at angles intersect each other at some point, the computer may warn the designer to this possible problem. In the past with 2-D drafting programs, this kind of problem could only be realized after certain sectional or auxiliary views of the object were drawn. Sometimes these mistakes are not even realized until after a part has been prototyped resulting in large losses of money and time for a company.

Parametric technology, such as Pro/ENGINEER, not only flags the user when possible errors develop, but also gives the designer the ability to set parameters (hence the name parametric) that are needed for product design. According to Gadh, "[For a designer] it may be important to catch the intersection between two holes while for [some other designer] it might be important to ensure that the two holes don't get closer than a certain amount. Parametric technology can do that as well." Pro/ENGINEER allows a user to design complex surface shapes and simulate the processes needed to produce a certain shape. For instance, the program allows you to simulate the structure of

an object made of sheet metal. In addition, external add-on programs currently being developed by Gadh and his graduate students will help determine where bends are best located in the sheet metal and how certain entities will look according tp the particular process by which they are manufactured.

The idea behind computer integrated concurrent design is for the computer and designer to interact with each other to determine the best course of action in the product design. The idea is not only to design the product, but also to figure out processes and activities that occur after the initial product design. Using a 'knowledge based expert system', parametric software technology will allow a computer to study the geometric features of an object and help determine what operations may be needed to manufacture it. For instance, if a part is to be injection molded, the



A configuration for a motor, drawn with a 3-D parametric modeling program called Pro/Engineer.

As technology grows, so do the demands of companies to produce high quality products with decreased design time

computer may let the designer know if moving parts may be needed on the molding die for proper part removal. This is extremely important. Moveable parts on a die may add anywhere from 10 to 30 percent of the total cost, so if the computer can help determine what holes are needed and which may be removed, a company can save a large amount of money.

While working in the American automotive market for companies such as Ford and GM, Gadh has experienced a first-hand knowledge of how parametric technology is shaping the manufacturing realm, "One of the things the automotive industry wants to do is cut down the concept-to-production time. The idea is that once you have an initial concept for a product, [you] try to build the product as quickly as possible," he says. With this technology, wasteful processes may be eliminated. "Instead of having to prototype a particular part seven or eight times, you might need to only do it three or four times."

Gadh believes that it is extremely important for students to be familiar with the same technology that companies are using. "The important thing is getting students educated in this [parametric] technology so that they can go out and provide these benefits to the companies." So how are students reacting to using Pro/ENGINEER? Dave Struebing, a first semester graduate student in Manufacturing Systems Engineering is currently taking ME 601, a course taught by Gadh in the use of Pro/ENGINEER for design. Although rather new to the program, he had this to say, "If you know AutoCad you can do solids modeling easily."

So what is next in this idea of computer integrated concurrent design? According to Gadh, large databases or 'knowledge bases' that can provide all design information to designers and manufacturers are needed. With these databases providing the information such as the stresses the designed part will encounter and the material the part may be made from, the computer may aid in the decision about proper design techniques. As technology grows, so do the demands of companies to produce high quality products with decreased design time. It is not too hard to believe that one day, designer and computer will become one and take on the manufacturing world.

AUTHOR BIO:

Mark Mastalski is a senior in Mechanical Engineering. This past summer he co-oped at Kohler Company, in Kohler, Wisconsin.

Agricultural Engineering

It's more than cows, mows and plows

Agriculture. When you think of agriculture you might think about plant physiology, farm management and other areas dealing with agricultural and life sciences. But not only does the College of Agricultural and Life Science (CALS) have departments devoted to these typical agricultural topics, it also supports a program that integrates biological science with engineering science called Agricultural Engineering.

Agricultural engineering is not a new discipline. It was developed in 1906 when the agricultural physics program divided into soils and agricultural engineering. That is why this major is not a part of the College of Engineering (COE). From 1906 until 1970, Agricultural engineers majored in mechanical or civil engineering. After completing the engineering degree, students enrolled in CALS for another year to complete the agricultural degree. In 1970 the college offered a four year degree program for agricultural engineers. Nationally, there are about 45 agricultural engineering programs. Here in Madison, the program contains 72 students, 85% men and 15% women.

"Advantages include small classes, one to one attention and solving biologically related problems."

What do Agricultural Engineers do? Agricultural engineers implement engineering technology in a biological environment. At UW-Madison, a student in the program can concentrate in one of four areas of study: food engineering, machinery systems, natural resources and environment and structures and environment.

Photo courtesy of Robyn Ryan.

A group of agricultural engineering students work together in lab.

Food engineering involves designing equipment needed in the food industry. This specialization is relatively new in the agricultural engineering department, and class opportunities are currently being expanded. Students take courses in chemistry, food science and machine design. People who concentrate in this area have been employed by Dean Foods, Hillshire Farms, Pillsbury, and General Mills.

Machinery Systems deals with designing off-road equipment, such as agricultural, construction and lawn and turf equipment, as well as designing pulp and paper-making and other processing equipment. Course study in this field includes mechanical and engineering mechanics courses as well as food science and other agricultural classes. Graduates often get jobs at John Deere, Case, Archer Daniel Midland, Caterpillar, Badger Northland and Gehl.

Natural Resources and Environment students are interested in run-off, land conservation, water and waste management. Courses in this area include surveying, hydrology, land planning, environmental engineering and concrete structures. Students receive jobs in the DNR, Soil Conservation Service and consulting firms. Mike Dreischmeier, an agricultural engineering and natural resources student, comments, "I'd like to work with farm land conservation, so that land is being used efficiently and effectively."

Structures and Environment students want to design and manufacture commercial agricultural structures and the environmental systems within these structures. Courses involve

classes on various structures, surveying, heating and cooling of those structures. Jobs are available with companies who are involved with agricultural structures as well as consulting firms.

Agricultural engineers also get an opportunity to gain work experience outside of the classroom through a summer internship. Students can work, get paid, gain experience and earn college credits. They have to write reports to fulfill the three credits. Some interns have worked at the DNR, Gehl, and Soil Conservation Service. Students can also gain experience by working on research with a professor. Some of the research on this campus includes nitrogen removal for on-site waste disposal, manure handling equipment with uniform spreading rates, developing non-destructive ways to detect ripeness in food and designing tillage and forage handling equipment.

...right now there may be an agricultural engineer sitting next to you in class and you do not even know it.

What are the advantages of being an agricultural engineering student? Since a number of professors have joint appointments between Agricultural Engineering and the College of Engineering and since agricultural engineers take a lot of engineering courses, agricultural engineering students are able to take advantage of the benefits of both campuses. They can use the services of the placement offices on both campuses, the co-op office and the Computer Aided Engineering center. The faculty-student ratio is low. Professor Jim Converse, the Agricultural Engineering department chair, points out, "Advantages include small classes, one-to-one attention and solving biologically related problems."

Agricultural engineers have a professional organization called the American Society of Agricultural Engineers, which has between 8000 and 9000 national members. There is a Wisconsin professional section as well as a student section. The student section holds meetings and takes field trips. They will be having a lawn mower clinic in the fall to raise funds. They also participate at Expo. Their 1993 exhibit demonstrated how to extract protein from alfalfa.

Photo courtesy of Robyn Ryan.

An example of farm equipment designed by agricultural engineers from the Machine Systems area.

So as you can see — agricultural engineering is not cows, mows and plows. It integrates engineering principles with biological sciences with the goal of producing an efficient and environmentally safe agricultural setting. In fact, right now there may be an agricultural engineer sitting next to you in class and you do not even know it.

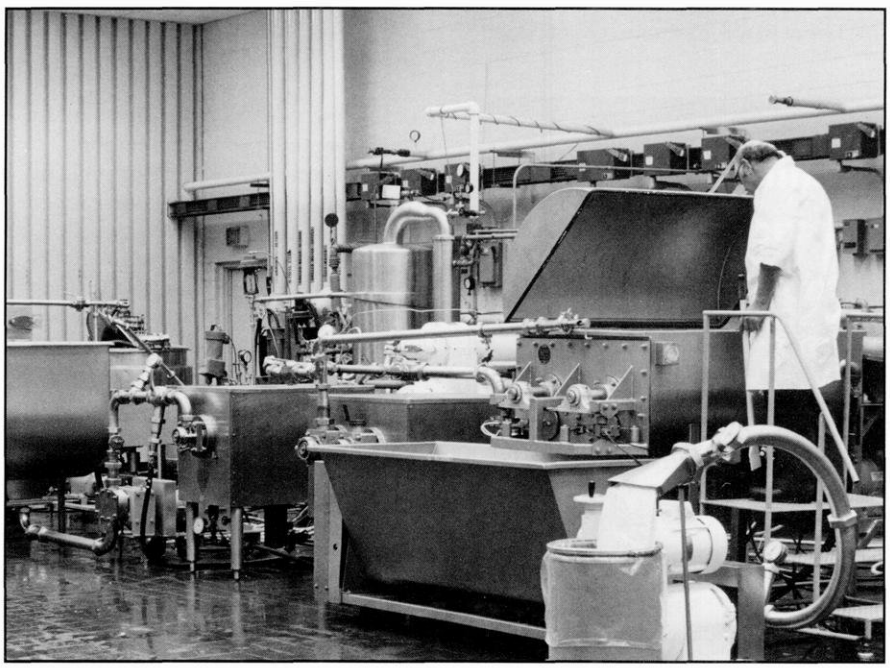


Photo courtesy of Robyn Ryan.

A potato grinding, blending and cooking machine at a pilot plant. Agricultural Engineers are key in designing and maintaining this kind of machinery.

AUTHOR BIO:
Robyn Ryan, a senior in Engineering Mechanics, held down 5 jobs this summer including 2 internships at the Biomechanics, lab at UW Hospital & Clinics and at WCSAR. After such a busy summer she looks forward to the welcome relief of school!

Thinking of Graduate School...

It is possible for a student as an undergraduate to increase their chances in enrollment at the University of Wisconsin or elsewhere in a graduate program of interest by planning ahead. Graduate and Undergraduate Admission procedures differ substantially and it is good to find out early what can be done to have the qualifications needed for acceptance to a particular institution.

Admission to Graduate School

Admission to Graduate School at the University of Wisconsin requires a minimum grade point average of 3.0 (/ 4.0) in the last 66 credits. While some departments in the College of Engineering may have a higher admission standard, all departments adhere to the minimum standard set by the University. In certain cases, students can petition for acceptance with a grade point average below the minimum set by the department.

Actions to Take as an Undergraduate

All departments stress that students who are thinking about graduate school should make an effort to talk to a faculty member in their area of study. According to Professor Emmert, Chairman of the Nuclear Engineering Department, students should "talk to a professor before considering graduate school to see if there is an area of study available and how the job market is for that area."

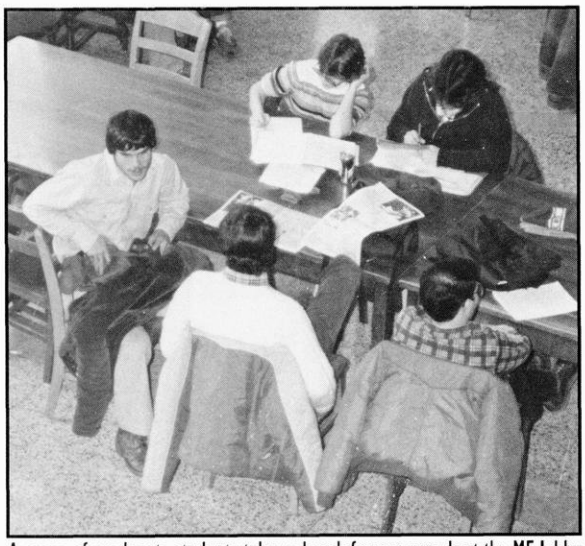


Photo from *Wisconsin Engineer* archive.

A group of graducate students takes a break from reaseach at the ME lobby.

Making contacts and connections with faculty members as an undergraduate can also help to open doors to graduate school funding and admission. Even if a student does not attend the University of Wisconsin for graduate school, good recommendations can make the difference for admission into graduate programs at other schools.

Making contacts and connections with faculty members as an undergraduate can also help to open doors to graduate school funding and admission.

Meeting the admission standards for a department is only the first step in acceptance into a graduate program. A student must also find a faculty member that is willing to be their advisor. Because of the growing number of students applying to graduate school in recent years it has become increasingly difficult for students to find a faculty member able to advise them.

Ways of making these connections with faculty members as an undergraduate include taking independent study in their area of interest, or obtaining a laboratory assistant position. Working with a faculty member on this level can increase the student's chances of having that faculty member find funding for that student later in graduate school. If the students decides to go elsewhere for graduate school, the experience will provide a good reference.

Funding

Graduate school tuition is substantially higher than undergraduate tuition. Funding is one of the biggest problems facing graduate students, since it is not available for all students. Fellowships, teaching and Research Assistant positions provide the means of financing graduate school for some. However, there is not enough funding available to support all graduate students. It is up to the individual faculty member in charge of the funding to choose students for Research Assistant positions. If in the past they have had a positive experience with a particular student or if a student has good recommendations from other faculty members, their chances of receiving some funding increase.

Departments in the college of engineering advise that a student obtain a co-op sometime during the time spent as an

undergraduate. Kathy Monroe, from the College of Engineering, explains, "We really push co-ops as part of the undergraduate experience." Having practical work experience can increase your chances of obtaining a research position in graduate school.

Having practical work experience can increase your chances of obtaining a research position in graducate school.

Graduate Records Examination

The Graduate Records Examination (GRE) is not required by the Graduate program at the University of Wisconsin, although in border line cases it may be used as the determining factor by a faculty member. According to Kathy Monroe, "The GRE is strictly between a faculty member and the student. Depending on the area of study a faculty may request to see your GRE scores to accept you into their field of study."

Senior Graduate Status

One option available to students is to take classes for graduate school while still enrolled as an undergraduate. If a student has six credits or less remaining for their degree as an undergraduate it is possible for them to sign up for classes that could be used once the student was admitted to graduate school. Interested students should contact their departments to find out more information.

Find Out More

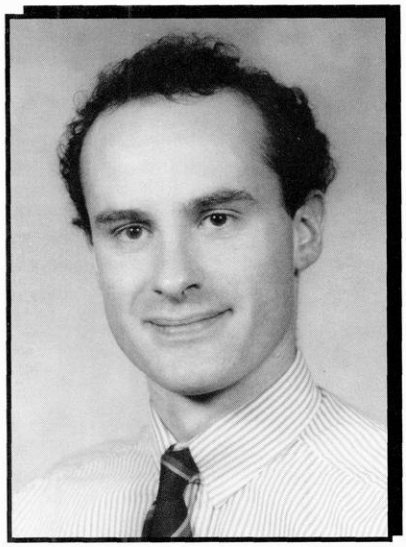
Talking to a faculty member is a good way for a student to realize all of the practicalities and possibilities of the goals they are pursuing. It also is a good way to find out early what can be accomplished as an undergraduate to better prepare for Graduate School. As Kathy Monroe says, "You really have to plan and put it all together".

AUTHOR BIO:
Dave Hubanks graduated last may with a degree in Mechanical Engineering. He spent the summer discovering the wonders of Europe, Egypt and Israel. Wow!

To find our information about graduate programs contact:

Department	Contact Person	PhoneNumber
Agricultural	Judy Ashford	262-2250
Civil & Environmental	Lynn Maertz	262-5198
Chemical	Donna Gabl	263-3138
Electrical &Computer	Kathy Monroe	262-2745
EngineeringMechanics	Rita Martinson	262-3990
Industrial	Sue Bader	263-3955
MaterialScience	Eric Hellstrom	263-9462
Mechanical	Linda Aaberg	262-0666
Nuclear	Gilbert Emmert	263-1648

Faculty Profile
Francious Sainfort



The Industrial Engineering department at UW-Madison is always up on the current technological and economic needs of our changing society. Here, Professor Francious Sainfort uses his technical background to analyze and solve economic problems involved in the ways machines are used, and the cost it takes to maintain them. "The I.E. program is a very interesting field to research, because of the available diversity of application," Sainfort says. He suggests that any undecided engineering student should take a good look at this program.

Sainfort originates from Grenoble, France, where he lived for eighteen years. After completing what we would call high school education, he left Grenoble and went to a university in Paris called "Paris Ecole Central", where he studied to get his undergraduate and master's degree in Industrial Engineering. While he was researching for his Ph.D., an interesting offer came his way. He was given the opportunity to to do his doctoral work in Montreal, Canada. Sainfort accepted the offer and flew to Montreal to begin his research immediately. " Montreal was a great change, it made researching a little bit easier," Sainfort says.

"I enjoy teaching because it's one on one, and it's fun to teach the students about applicable diversity in the field that I've dealt with for ten years."

It was not until a year later that Sainfort met a friend named David Gustuffson who helped him find placement in the I.E. Department here at UW- Madison as an Assistant Professor. "David was a very influential part in helping [me] find that start that I was looking for, and Madison seemed like a good place to be. I had heard good things about the program there, and it proved to be the right choice," Sainfort says. Finally arriving at Madison, Sainfort taught as an Assistant Professor and continued to research for his Ph.D. ,which took two more years of study to complete.

Right now it is possible to find Sainfort in his office in the Industrial Engineering department in the Mechanical Engineering building, teaching one of his classes, or at one of the several committees that he is currently involved with. One such committee is the Institute of Industrial Engineers (I.I.E.). This committee is involved in brainstorming the current technologies of a given field to see what kinds of improvements can be made. " I enjoy working with this committee because it is interesting to see the different ways of improvement in any field," Sainfort comments.

Sainfort also works with the MDM (Medical Decision Making Society), where he spends much time analyzing systems that could be made more efficient. Once a system has been analyzed, Sainfort is then responsible for finding a new more efficient way to use that system. " It 's fun to see what improvements can be made the existing technologies."

Considering that Sainfort is involved in at least five Industrial Engineering related organizations outside of the classroom, it might seem impossible for him to maintain his daily role with the required alertness needed for success. That is not the case says junior Emily Dickinson from his Decision Sciences class, "He seems to do a very good job in getting the material across in an easy to understand way." When asked why he enjoys teaching, Sainfort responds by saying,"I enjoy teaching because its one on one, and it's fun to teach the students about applicable diversity in the field that I've dealt with for ten years."

Despite all that Sainfort does with his day, he still finds time for some exercise, either by playing tennis, or his favorite game, soccer. " I find it rather enjoyable to let the daily stress off by taking it out in a good match of tennis, or a soccer game," he says.

Sainfort is a true example of a well rounded individual with a great deal to offer. He suggests that everyone should find something they would enjoy contributing there time to. He adds, "Once you realize that it is possible to make a difference, the actual work you put into it doesn't seem like work at all anymore."

AUTHOR BIO:
John Gilbert is currently a sophomore. He is heading for a degree in Industrial Engineering.

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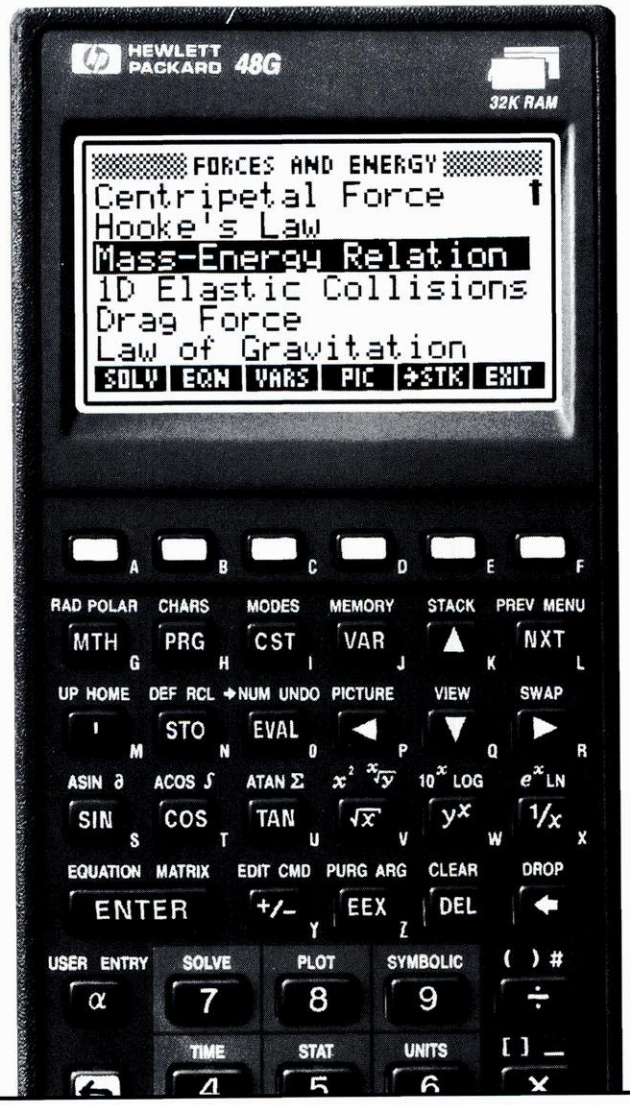

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