CAD/CAM NEWSLETTER

November 1985

Information Compiled by the Canadian CAD/CAM Council for the Advancement of Computer Integrated Manufacturing

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1. A Message from the Pulp and Paper Industry

A recent article on the status of computer control systems in the Canadian pulp and paper industry carries a message that could be important to the general manufacturing industry concerning CAD/CAM and computer integrated manufacturing systems. The article, which appeared in the October 1985 Bulletin of the Canadian Industrial Computer Society, describes two evolving situations, each of which carries a message:

- "The pulp and paper industry initiated computer control some twenty years ago. Today, most paper machines in the world are computer controlled, [many other processes are computer controlled] and millwide control is a hot topic. However, despite this apparently good situation, the pulp and paper industry is faced with serious problems. First, as shown by recent surveys, the industry suffers from a chronic lack of control engineers. Two major factors are: an insufficient supply of control engineers from Canadian universities, and the failure of the industry to attract and keep those engineers."

- "Second, partly as a consequence of the first problem, most control systems are turnkey, vendor-supplied systems -- and the tuning of these systems is often left to the vendor. In other words, in the age of increasing automation, many mills do not control a major aspect of the mill operation, which has direct impact on efficiency. -- This situation is almost unheard of in the chemical and petrochemical industries."

Let us hope that twenty years from now this situation will remain unheard of in the discrete parts manufacturing industries where the CAD/CAM and CIM revolution is progressing in full swing.

Notwithstanding that there are approximately 150 mills in Canada, and that mill wide control systems are being increasingly considered for competitive reasons, a pulp and paper industry survey, after some 20 years of this technology application, was able to identify only 25 engineers in Canada with systems knowledge and experience in the four essential technology areas; knowledge of the physical process, control systems technology, computer systems technology, sensors and instrumentation.

The consequences are serious, in an industry with approximately 150 mills, but presumably could be remedied if there were something in the order of several hundred knowledgeable and experienced systems engineers and systems managers distributed over the industry.

One hopes that a parallel shortage will not be "discovered" twenty years from now in the CAD/CAM field where there are tens of thousands of Canadian plants involved. The consequences would be even more serious, and the cost of getting back on track almost beyond comprehension.

2. US Study Examines CIM as a National Opportunity

"The most critical problem faced by too many U.S. industrial executives today is the steady decline in their companies' competitiveness at home and abroad, and the resultant loss in market share. A major reason for the decline has been the gradual emergence of a technology gap in manufacturing. It has not been a single identifiable event, but a slow erosion of the technological foundation of manufacturing. The keys to regaining competitiveness in most U.S. manufacturing industries are quality, productivity, and responsiveness in bringing new products to the marketplace. A primary technology for attaining these attributes, across industries, is computer-integrated manufacturing."

The above is the opening paragraph from a 1984 National Academy Press report prepared for the National Research Council in the U.S.A. with support from the National Aeronautics and Space Administration (NASA) and the National Academy of Sciences.

The study and report appears to arise because of two major objectives which have been assigned to NASA:

- to launch a Manned Space Station by 1992 with a budget of $8 billion
- to be a leader in the development and application of productivity enhancing technology.

To extend its work into the area of computer integrated manufacturing, and in response to a NASA request, a twelve man study team was formed in 1983 which visited company sites and prepared case studies based on five selected companies that have made significant progress towards CAD/CAM integration. Significant help in preparation of the report was obtained from companies and organizations such as Deere and Company, General Motors, Ingersoll Milling Machine Company, McDonnell Aircraft Company, Westinghouse, the IPAD staff group at Boeing, the ICAM program of the USAF and the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards.

From these sources estimates were obtained of the intermediate benefits obtained from computer integrated manufacturing, derived from a 10 to 20 year effort, with further ultimate benefits expected as full integration is approached.

The intermediate benefits achieved are:

Reduction in engineering design cost	15-30%
Reduction in overall lead time	30-60%
Increased product quality as measured by yield of acceptable product	2-5 times previous
Increased capability of engineers as measured by extent and depth of analysis in same or less time than previously	3-35 times
Increased productivity of production operations (complete assemblies)	40-70%
Increased productivity (operating time) of capital equipment	2-3 times
Reduction of work in process	30-60%
Reduction of personnel costs	5-20%

Some other additional observations from the sixty-three page report are:

- Direct involvement of top management was found to be the key to successful CIM in the companies visited
- Each of these leading companies introduced computer integration only after serious consideration of the resources required, the risks, and the expected benefits
- Generally companies had started their activities in the two separate areas of CAD and CAM as "islands of automation", but later linked their narrow applications and gradually brought them together to broaden their integration effort
- Companies independently concluded that the usual financial measures, such as return on investment, were inadequate for assessing the results of integration
- These pioneers learned what is still obvious today; it is enormously difficult to link heterogeneous groups of hardware and software
- The most formidable technological barrier to CAD/CAM integration is the transfer of geometry and instructions across the design-production interface
- Far too few companies are working seriously to adapt the concept of CIM to their operation
- A number of the report recommendations arise from the recognition that the implementation of CIM exceeds the capabilities of most individual manufacturing organizations.
- The committee producing the report believes that a majority of U.S. manufacturers will not be able to remain competitive in the quality, timeliness of delivery, and the cost of their products unless they use CIM.

The report recommends that NASA adopt a strategy of CIM for its Manned Space Program; that companies form consortia for CIM projects not readily undertaken by individual companies; that the CASA/SME organization be increasingly recognized and used as a knowledge and information centre for CIM.

Three of the most publicized government programs in the U.S.A. in support of CAD/CAM technologies have been the USAF program for Integrated Computer Aided Manufacturing (ICAM), the Integrated Program for Aerospace Vehicle Design (IPAD) sponsored by both NASA and the Navy, and the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. As these programs reach their stated objectives, or reach the end of their initial budget approval period in the next year or so, it would appear possible from a reading of this report that continuity of support will emerge under the NASA space program, plus continued defence program support in general.

Copies of the report "Computer Integration of Engineering Design and Production: A National Opportunity" may still be available in limited supply.

Contact: Manufacturing Studies Board
National Research Council
2101 Constitution Avenue
Washington, D.C. 20418, U.S.A.

3. Advanced Manufacturing Technologies Mission to Japan

The following summary is based on notes provided by Dr. U. Graefe, Division of Mechanical Engineering, National Research Council, which summarize observations made during a mission to Japan Nov. 1-11, 1985 to investigate advanced manufacturing technologies.

The mission was composed of two groups. One included representatives of eight companies who explored individual industrial cooperation opportunities with Japanese companies. The second group made up of members representing various associations in the manufacturing area formed an Industry Awareness Project Team which obtained first-hand experience and additional information on the use of advanced manufacturing technologies in Japan. The second group included representatives from the Canadian Manufacturers' Association (CMA), the Machinery and Equipment Manufacturers' Association of Canada (MEMAC), the Ontario Centre for Advanced Manufacturing (OCAM), the CAD/CAM Association CAO/FAO, the National Research Council (NRC), and Robotics International of the Society of Manufacturing Engineers (RI/SME).

The main conclusion both groups arrived at were the following:

The technology used in manufacturing in Japan is well understood in North America.

The most impressive feature, and the fact that makes Japanese manufacture so effective is how their manufacturing facilities are managed and the technology is applied. Japanese management is geared towards integrated manufacturing.

Examination of the factories revealed surprises on two fronts. The relatively standard technology used and the fantastically successful application of this technology. The technology used in Japan on the factory floor, in machine tools, sensors and material handling devices is well understood in North America, in fact, more advanced technology is often used in North America in some areas; the area of CAD, for instance. Relatively few sensors were used in the highly automated plants, and in case of malfunctions in machinery the affected machines were shut down and awaited human attention. No fancy attempts at automatic exception handling using artificial intelligence (AI) methods were in evidence. In fact, AI and expert systems, the latest buzzwords in North America, were not heard once. The guiding philosophy appeared to be "Keep it Simple".

The application of this technology, however, was astounding. The most visual impact was to see acres of shop floor covered with machine tools, robots and automated guided vehicles busy producing a variety of parts with hardly any people visible on the floor.

People were mainly used in setting up parts on pallets during 2 shifts in a day with the machines working on these palletized parts for 3 shifts a day, sometimes for 7 days a week, which implies one unmanned shift per day as well as some unmanned weekend shifts. Less visible, but even more important, was the lack of large in-process inventory on the shop floor, the drastically reduced in-process time (30 to 1 in some cases), improved product quality and reduced floor space requirements.

In general, the companies visited have adopted the "Just in Time" or JIT concept, rather than the North American "Just in Case" or JIC concept. Loosely translated, JIT means that raw material comes in one end of the plant and shortly (very shortly) afterwards, the finished product is shipped to a customer. JIC, on the other hand, means that regardless of what goes wrong, there is a backup to keep production flowing. Almost no matter what might happen, despite every imaginable interruption, factories can deliver goods.

What Should Canadian Industry Do?

Based on what was seen in Japan, the impressive position of the Japanese manufacturing industry is not so much based on technology but on its management techniques. What hits the eye is the large scale of automation achieved. This automation is necessary in Japan, due to the extreme labor shortage in the manufacturing industry. However, direct labor cost is a small part of the total cost and hence savings due to a reduction in direct labor are small, compared to the savings that can be achieved in adopting different management concepts and production philosophies.

What Canadian Industry should do is to adopt an integrated manufacturing paradigm. In the words of the Ingersoll Engineers' report 'Integrated Manufacture', they should assess real business needs and then simplify the means to meet them. They should integrate the business, but only in areas where it serves business needs, and implement computer technology only if it really contributes to overall business needs. 60 to 70% of the benefits accruing from a conversion from JIC to JIT can be achieved without heavy investment in technology.

Canadian companies should determine real cost figures for defective parts, resulting work stoppages and rework. The results should provide an eye opener and provide an incentive for quality assurance (not the after the fact quality control) as one of the corporate goals. Set up is the most time-consuming interruption that has to be reduced. The use of MRP and scheduling packages integrated with a manufacturing data base can reduce excessive in-process inventory, and the need for expeditors and progress chasers. Quality and cost should be the driving force, not production.

To convert a company's management from its current mode of operation to one that can deal effectively with integrated manufacturing concepts is not an easy step.

The Industry Awareness Project team is currently consolidating the impressions and information gathered by its members and determining the means by which this material can best be disseminated to Canadian Industry. A videotape of on-site images and observations, if this can be arranged, would provide maximum exposure, communication and impact to the widest possible audience.

4. Robot Study Predicts Change in Work Force

Robotics will play an increasingly important role in American industry over the next 10 years, displacing some 4% of the work force throughout industry, but creating nearly 50,000 robotics-related jobs, according to a study just released by the Society of Manufacturing Engineers (SME) and The University of Michigan.

The "U.S. Industrial Robot Forecast and Trends: A Second Edition Delphi Study", which projects trends in robotics based on a five-year study, also reports that:

- Annual domestic sales of robots will increase from the current 5,000 units to 10,000 units by the end of the decade and 20,000 by the end of the century--from $240 million in sales this year to $637 million (1983 dollars) in 1995.

- The automotive industry, which now buys 51% of the robots, will continue to increase unit purchases, but because of relatively faster growth of sales to other industries, the automotive market share will decline to 26% in 1995. By contrast, electronic companies, which now account for 8% of sales, will double to 16% in the same period.

- More industrial robots will be marked by changes in appearance, more accuracy and greater variety. By 1995, 15% will have two or more arms; 11% will be mounted on ceilings or walls; 21% will move along a track; and 90% will be controlled by computers.

- Vision, tactile and other sensory devices will be utilized by 60% of all robots, especially those used for inspection, assembly and welding.

- Robotics-manufacturing will create more than 44,500 jobs by 1995, including 25,000 maintenance workers, 12,000 programmers, 4,500 workers in supply firms and 3,000 workers in manufacturing firms.

- The overall displacement of workers by robots will reach 4.3% of the total work force by 1995, but nearly 90% of those employees will remain with their companies. Most displaced workers will receive lateral transfers to new jobs requiring similar skill levels; 10% will be promoted; and 10% will be demoted. Only 6% will quit or be laid off.

- Ten percent of those workers who quit or are laid off will find new jobs in at least two months, 37% within six months, and 73% within a year. About 1,000 workers per year through 1990 will be unable to find alternative employment due to a lack of marketable skills.

- The automotive industry will experience the highest displacement level, increasing from 5% (25,000 workers) this year to 18% (90,000 workers) by 1995. The electronics industry will go from a 3% displacement to 15%, followed by the primary metals industry, 10%; consumer nondurables, 10%; and aerospace, 10% in 1995. Little, if any, displacement will be experienced in agriculture, construction and electricity generation.

- Occupations most affected by robot installations will include production painters, 20% displacement; welders and flamecutters, 20%; machinists and machine operators, 13%; and assembly workers, 10%. Line supervisory personnel will decline by 3%.

- A more highly trained labor force will be necessary, and entry-level jobs "with no training or experience necessary" will be rare. As a result, the national high school dropout rate should decrease from the current 20% to 13% by 1995. More young people will enter the work force from technical school or college.

- Private industry will bear the brunt of re-training costs for displaced workers. Re-training provisions will become increasingly prevalent in union-management contracts, with management likely providing early warning of impending technological change in the workplace.

- The eastern North Central states, home of the automotive industry, will remain a leader in the number of manufacturing firms, although the region's share will decline from the current 40% to 28% in 1995. The Pacific states, the center of electronic production, will gain a substantial share of robot producers, from the current 12% to 17%.

Many manufacturers believe the installation of robots will result in lower labor costs, enhanced product quality, fewer defects and a better flow of materials, says the report, adding that robotics will require more highly skilled employees.

It notes that in the 1960s and 1970s "there was widespread concern that the rapidly increasing presence of the computer in the office would lead to the massive disemployment of staff." In the 1980s, a similar wave of concern has been underway. Although the focus has been on production-level jobs rather than on office positions, there have been widespread fears again that workers will report for duty one day only to find a robot has suddenly rendered them obsolete.

"However, as with the computer revolution, the robot revolution also appears to hold the promise of creating jobs as well as competing for them. Perhaps the single greatest area of change that will be wrought by robotization will be the need for a better-educated work force."

The report was written by Donald N. Smith, Director of the Industrial Development Division (IDD) of the Institute of Science and Technology at the U-M, and Peter Heytler Jr., an IDD research associate. For a copy of the 212-page report, contact:

Robotics International of the Society of Manufacturing Engineers
One SME Drive, P.O. Box 930
Dearborn, Michigan, U.S.A.
Telephone: (313) 271-1500

(Reproduced from "Manufacturing Frontiers", October 1985)

5. Product Definition Data Interface (PDDI)

PDDI - Another acronym and yet one that deserves attention. What is it, and what role is it expected to play in computer integrated manufacturing? In a nutshell, the extent and purpose is as follows.

Basically PDDI seeks to provide a knowledge bridge that is critical to the linking of CAD and CAM. CAD technology has developed to the point where the geometric data base for a part can be stored in computer memory, and even transferred from one computer type to another by software and standards such as the Initial Graphics Exchange Specification (IGES). However, while all the lines, circles, surfaces, etc. that make up the parts drawing are stored in the computer, and even transferable from one system to another, there remains a need for a system which can recognize parts features from the data base. This is necessary if fully automated generation of process plans and manufacture is to follow. Both the U.S. Air Force PDDI project, the closely related IMPACT project of CAM-I and the expert system for process planning XPS-E address this area of feature recognition and decision processing for integrated process planning and NC data generation.

"A series of presentations and demonstrations were given on PDDI [at a recent industry review in St. Louis, sponsored by the U.S. Air Force]. The PDDI project was awarded to McDonnell Aircraft Company in 1982, and addressed the manufacturing requirements for a digital product definition. Digital product definition will replace the function of blueprints in manufacturing, and is a crucial step toward the realization of the truly paperless factory. Currently, Computer Aided Design/Drafting (CAD) systems store information in a manner appropriate to drawing the part (i.e., as lines, circles, and arcs). The objective of the PDDI project, on the other hand, was to identify requirements for a computer model which stores the information necessary to manufacture the part.

The first task, performed largely by Booz, Allen and Hamilton Inc., was to evaluate the Initial Graphics Exchange Specification (IGES), which is a standard for the exchange of graphical information between dissimilar CAD systems. The second task was to define information requirements for manufacturing functions using purely digital data.

The PDDI project has resulted in a method whereby a part is viewed as a collection of features such as holes, slots, fillets, webs, and so on. Also, various applications such as engineering analysis, drafting, process planning, NC programming, and inspection all access the same part model. A single part model to support all manufacturing and engineering applications eliminates the creation and maintenance of multiple data bases. The PDDI project has also defined a neutral exchange format so that dissimilar CAD and CAM systems can share the same data.

Four classes of parts were used to perform various engineering and manufacturing functions in the PDDI demonstration. The functions that were demonstrated included, but were not limited to, NC machining, process planning, and inspection. Two dissimilar CAD systems (Computervision and McDonnell Douglas Manufacturing Information Systems) also demonstrated the ability to access and use the PDDI part models.

The PDDI effort is expected to form the basis for a digital product data exchange standard for the Air Force. The Air Force recently awarded the Geometric Modelling Applications Program (GMAP) to Pratt and Whitney Aircraft in East Hartford, Connecticut. This effort will extend the PDDI concept to complex turned parts and other support areas of manufacturing. PDDI is also expected to heavily influence an effort currently underway in the IGES community called the Product Data Exchange Standard (PDES). PDES will be the United States' entry into the international standards community effort to define a complete digital product definition exchange standard."

In summary:

- The PDDI project at McDonnell Douglas is considered to be complete and many believe an important milestone has been reached. Part of the software developed is in the public domain and available to the U.S. industry.
- Further work continues with USAF sponsorship via the GMAP project at Pratt and Whitney.
- PDES, which is directed towards development of an international standard, rather than software for U.S. firms only, has been initiated at the National Bureau of Standards.

(The quoted portion of the above review is reproduced from Manufacturing Frontiers, October 1985.)

6. A Difference in Professional Emphasis

Figures from a bar graph in American Machinist, June 1985 and Manufacturing Productivity Frontiers, September 1985 provide an interesting and revealing difference in professional emphasis between the USA and Japan. As near as one can read the numbers from the printed graph, the data is as follows for the number of each professional group per 10,000 population.

	USA	JAPAN
Engineers	25	35
Accountants	40	3
Lawyers	20	1

7. CAD/CAM Articles of Recent Interest

"Special Report on the U.S. Robot Industry" R. Schreiber
Robotics Today, October 1985 pp. 35-42.

A special report prepared by the editorial staff of Robotics Today reviews the status of the U.S. robot industry. The industry is seen as maturing, with increasing sales but still beset with high competition and negative profit margins. Sales are becoming increasingly systems oriented. Impediments are the rapid advance in technology which makes it extremely difficult for engineering staff in user organizations, and especially managers, to understand the tools available. A need is seen to make university and government sponsored research more relevant by a tighter coupling to industry. A review of robotic standards activity is included plus a forecast of robot sales by application class.

"Technology: The Permanent Wave" F.D. Barrett
Business Quarterly, Spring 1985 pp. 43-52.

A Toronto based management consultant underscores the pervasive role of technology in today's world economy such that it is now

everybody's business. All companies are urged to realize that the product, service and productivity of their company, like every company, is based on some technology no matter how simple or how traditional. Numerous examples are given. Managers in such specialized areas as Human Resources, Finance and Accounting are invited to question what they have to contribute to the firm's ability to survive in a technological world. Policies for technology management, with scientists and creative technologists on the corporate board, are recommended.

"Programmable Automation and the Workplace" M.S. Blumenthal IEEE Technology and Society Magazine, March 1985 pp. 10-15.

The author, who is with the U.S. Congress, Office of Technology Assessment (OTA), reviews the employment impacts of programmable automation in manufacturing. The proportions of skills and occupations found in manufacturing are expected to shift substantially, an effect that so far has been more striking than any change in the level of employment. The principal effect of programmable automation will be displacement of labor, but the effect will not be cataclysmic because use is small, concentrated in a few industries and the spread or diffusion of a new technology takes considerable time. Robots are only one form of programmable automation whose employment effects will combine with those of other computerized manufacturing technologies. Effects will be focussed more on some occupational skills and geographic areas than others. For some, such as engineers, computer scientists, technicians, mechanics, etc. demand will rise. The size mix of firms may change in user industries since larger firms have a head start in applying these technologies, but the long term outcome is uncertain.

"How Workers Feel About Their Jobs on Flexible Manufacturing Systems: Implications for Organizational Design" M. Blumberg, D. Gerwin Commline May-June 1985 pp. 10-13.

An in-depth study is made on the job satisfaction of employees in a flexible manufacturing system. The system studied was one obtained in 1972 by the tractor division of a major U.S. company, and was the second installation in the country. Six general purpose machining centres receive large tractor housings which are palletized and routed to the machining stations on four wheel carts driven by tow chains. Operation is two shift with an occasional third shift.

Most workers on the FMS are dissatisfied. Work on the FMS is not a soft job. Repairmen, who perform the most technically demanding work, have the most control over their jobs. Tool setters, operators and loaders were dissatisfied with practically every aspect of their jobs. The foreman's job on the FMS is extremely stressful. The foreman must have a good working knowledge of the equipment. His need for leadership skills is not diminished due to dependence on staff and service personnel and the need to solicit their cooperation. A reorganization of work, based on the group rather than the individual, and job rotation within the team is recommended as corrective action.

8. CAD/CAM Information Available

- Software Directory and Technical Bulletins

Several new CAD/CAM related publications are available from Engineering Information Inc., a not-for-profit information service well known as the publishers of the Engineering Index.

Publications available of special interest to persons with interests in computer integrated manufacturing include:

- "The Engineering Software Directory" - to be published in the fall of 1985 and annually, the directory reports on and indexes approximately 4000 U.S. engineering and manufacturing software packages currently available for all types of computers from micros to main frames. Introductory price $67.50 (U.S.).

- "Technical Bulletins" - individual technical bulletins are available on approximately twenty different subjects including one each on Robotics, CAD/CAM and Computer Graphics. Each of these three publications gives concise, state-of-the-art bibliographies of recent R&D achievements over the past five years based on information abstracted from over 4500 professional and trade journals, conference proceedings, etc., thus providing a convenient subject oriented overview of the literature in a particular subject area. $49.50 (U.S.) each.

Other publications, of a broader nature include the Engineering Index, Engineering Conference Index and Compendex (a machine readable version of Engineering Index on magnetic tape.)

Contact: Engineering Information, Inc.,
345 East 47th Street
New York, N.Y. 10017-2387, U.S.A.
Telephone: (212) 705-7615
(800) 221-1044

9. Conference Reviews

We are indebted to G. Puukila of the Canadian Microelectronics Corporation at Queen's University for the following conference review.

Newsletter readers who might wish to submit similar reviews of conferences strongly oriented to CAD/CAM and CIM technology to the newsletter editor for possible inclusion in the newsletter are invited to do so. This could be a valuable addition to the newsletter, particularly for conference reviews that are short, concise, to the point and which refer to the availability of the proceedings for those who wish further detail.

- 1985 Canadian Conference on Very Large Scale Integration

The third annual Canadian Conference on Very Large Scale Integration was recently hosted by the University of Toronto at the Royal York Hotel in Toronto on November 4th and 5th, 1985. The other sponsors included Bell Northern Research, Canadian Microelectronics Corporation, IEEE, Linear Technology Incorporated, Mitel Corporation, Natural Sciences and Engineering Research Council (NSERC) and Northern Telecom Electronics. The Conference provided a forum for the presentation of VLSI research in Canadian Universities and helped to promote interaction between industrial and university research in the VLSI area. The areas covered in the presentations included Technology and Design, Device Physics and Modeling, Design Automation Software, Applications and Testing.

The first day began with an invited paper by D. Smeaton of Mitel Corporation describing the emergence of CMOS and its application in the telecommunications industry. The university presentations concentrated on design and implementation of various algorithms, components and architectures. The preferred technology was CMOS, which reflected the process available through the implementation service of the Canadian Microelectronics Corporation.

The second day was organized into two parallel sessions, with R.B. Fair of the Microelectronics Center of North Carolina presenting an invited paper on "The Role of Rapid Thermal Processing in Scaled CMOS." The morning sessions were divided into two tracks dealing mainly with Design Automation and Modeling, and Device Physics and Design. The afternoon sessions covered Design Automation and Modelling, and Applications and Testing.

The guest speaker following the luncheon was G.M. MacNabb, president of NSERC. He praised the VLSI research program as an example of the cooperative effort possible between universities and industry with the government acting as a funding catalyst. Concern was expressed for the funding of NSERC programs and for the details involved in the proposed creation of national Microelectronics Research Centres.

Two papers shared the best student paper award donated this year by Bell Northern Research. They were both from the University of Toronto:

"Expandable Arithmetic Block Macrocell" by A.S. Shubat J.A. Pretorius and C.A.T. Salama

and

"ALTOR: An Automatic Standard Cell Layout Program" by J.S. Rose, W.M. Snelgrove and Z.G. Vranesic.

A limited number of the conference proceedings are available for $25 by contacting the Technical Program Chairman A. Salama at the Department of Electrical Engineering, 35 Saint George Street, Room 204, University of Toronto, Toronto, Ontario, M5S 1A4.

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10. CAD/CAM Conferences, Exhibitions, Workshops and Seminars

- "CIMTECH"
March 10-13, 1986, Boston, Massachusetts

According to the call for papers, which closed Oct. 15, 1985, the CIMTECH conference and exhibition sponsored by CASA/SME will be held in Boston, March 10-13, 1986. Papers have been requested from qualified speakers emphasizing case studies and experience in the integration aspects of computer integrated manufacturing.

Contact: Computer and Automated Systems Association
Society of Manufacturing Engineers
One SME Drive, P.O. Box 930
Dearborn, Michigan 48121, U.S.A.

- "1986 IEEE International Conference on Robotics and Automation"
April 7-10, 1986 The San Francisco Hilton & Tower, San Francisco

The advance announcement for this conference has been issued by its sponsor, the IEEE Council on Robotics and Automation. The organizers are placing special emphasis on the broader aspects of robotics and automation, such as flexible manufacturing, material handling, scheduling and control, system design and control, modeling and simulation, economic evaluation. Papers describing novel theory and/or applications have been invited. Specific topics are expected to include, simulation languages, graphic animation, robot modeling, kinematics, dynamics, robot sensing, computer vision, robot programming languages, ergonomics, socio-technical factors, applications in industry, space, underwater and hostile environments plus expert systems in robotics and manufacturing.

Special full day tutorials will be held April 7 in (1) Manufacturing Systems Models, and (2) Robotics Assembly.

For conference information,

Contact: Robotics & Automation
c/o Harry Hayman
738 Whitaker Terrace
Silver Springs, MD 20901, U.S.A.
(301) 434-1990

- "Robots '85"
April 20-24, 1986, Chicago, Illinois, U.S.A.

For information concerning this major robots conference and exhibition,

Contact: Robotics International of SME
One SME Drive, P.O. Box 930
Dearborn, Michigan 48121, U.S.A.
(313) 271-1080 ext. 355

- "5th Canadian CAD/CAM & Robotics Conference and Exposition"
June 17-19, 1986, Toronto, Ontario

Call for papers has been issued for the above annual conference, sponsored in 1986 by The Society of Manufacturing Engineers with co-sponsorship by the Canadian Institute of Metalworking and the Ontario Centre for Advanced Manufacturing.

Abstracts of papers of approximately 300 words must be submitted for review by Jan. 15, 1986. Authors will be notified concerning acceptance. Final papers of 3000-4000 words in length will be required April 15 for publication in the proceedings.

Abstracts for papers should be submitted to:

Chair, Technical Review Committee
c/o Shannon Kyles
CAD/CAM and Robotics Conference
SME, 1 SME Drive
Dearborn, Michigan 48121, U.S.A.

- "23rd ACM/IEEE Design Automation Conference (DAC 86)"
June 29-July 2, 1986, Las Vegas, Nevada, U.S.A.

Of prime interest to persons involved in CAD and CAM applied to printed circuit board and integrated circuit design and manufacture, the "DAC 86" conference will embrace a wide range of topics including:

- Simulation
- Testing, Diagnosis
- IC Layout
- Silicon Compilation
- PCB Placement and Routing
- Layout Verification, Design Rule Checking
- PLA and Logic Level Design Aids
- System Level Design Aids
- Hardware Description Languages
- Special Purpose Hardware for DA
- Solid Modeling, Mechanical CAD
- Human Factors in DA
- Databases
- CAM, Robotics
- Software Engineering in DA
- Expert Systems

Further information concerning the conference program will be available from the IEEE Computer Society, the Association for Computing Machinery (ACM) or by contacting the program chairman

Contact: Donald E. Thomas
IBM Thomas J. Watson Research Center
P.O. Box 218
Yorktown Heights, NY 10598, U.S.A.

- "Robotics Research: The Next Five Years and Beyond"
Aug.19-21, 1986, Scottsdale, Arizona

Call for papers has been issued by Robotics International of SME.

The Second World Conference on Robotics Research will include formal technical presentations, interactive breakout sessions on selected subjects, and poster sessions on a wide range of topics. Presentations from leading experts from industry and universities, worldwide, will be invited. Presentations from attendees will include individuals from a vast number of corporations and universities.

The Second World Conference on Robotics Research will include tours of Arizona State University in Tempe, Arizona. Founded in 1885, Arizona State University has become a major contributor to the field of high technology research. With the opening of the Engineering Research Center in March 1984, ASU has conducted extensive research in the areas of Computer Vision, Pattern Recognition and Intelligent Robots.

Contact: Robotics International of SME
One SME Drive, P.O. Box 930
Dearborn, Michigan 48121, U.S.A.
(313) 271-1500 ext. 359

- "The Automated Guided Vehicle Conference"
September 22-23, 1986, Long Beach, California

The Society of Manufacturing Engineers (SME) will hold its first Automated Guided Vehicle (AGV) conference as noted above. Case studies and special topics under consideration for conference emphasis include:

Tow vehicles
Unit load carriers
Pallet trucks
Side load or specialty type AGV's
Sensors
Position magnets
Guide path design
Control Systems (Intelligent/non-intelligent)
Load Mechanisms
Traffic control/Central control
Wireless guidance

Contact: AGV Administrator
Technical Activities Department
Society of Manufacturing Engineers
One SME Drive, P.O. Box 930
Dearborn, MI 48121, USA
(313) 271-1500, ext. 355

- "The Map Conference and ULTRATECH Exposition"
September 23-24, 1986, Long Beach, California

The MAP Conference, sponsored by the SME, is one of eight conferences exploring technology applications in a wide range of manufacturing fields as part of the ULTRATECH conference and exposition September 22-25. The eight conferences, running concurrently with the exposition at the Long Beach Convention Centre are:

- The MAP Conference
- Artificial Intelligence in Manufacturing
- Automated Guided Vehicles (as noted above)
- FINSTRAT
- Human Aspects of Automation
- Robots West
- Simulation
- Vision West

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11. Twenty Selected CAD/CAM Abstracts

For a review of CAD/CAM developments around the world and recommended further reading to help keep your organization informed on the challenges and opportunities involved, see the selection of twenty CAD/CAM abstracts in the section attached for this month.

While the abstracts are informative in themselves, copies of most of the articles cited can be obtained from your nearest technical library or from the Canada Institute for Scientific and Technical Information (CISTI) as noted in the abstracts section.

12. CAD/CAM Quotes

- "Barriers to the adoption of advanced manufacturing technology (AMT) by Ontario manufacturers are the product of management attitude rather than financial constraints."

  Review of the Foster Research Services study and report prepared for the Ontario Centre for Advanced Manufacturing. Canadian Machinery and Metalworking, October 1985.

- "The list of reasons why Canadian companies don't automate is as long as your arm ---." "I believe it comes down to the fact that Canadian managers are cautious, reluctant to try something new or to push for an idea even when they recognize the benefits. Those companies that have been most successful in implementing technology, like Northern Telecom, have had the full support of management. This is an absolute must".

  Guest editorial by Ian Barrie, General Manager, Ontario Robotics Centre in CAD/CAM and Robotics, October 1985.

- "Many firms may not be managed well enough to handle the change."

  James Hardy, President Computer and Automated Systems Association (CASA) of the Society of Manufacturing Engineers reporting to a Toronto audience on a USA study of CIM supported by NASA and the National Academy of Sciences. Canadian Machinery and Metalworking, August 1985. (Reviewed in detail in section 2 of the newsletter.)

- "Canadians must realize that CAD/CAM technology is an essential tool in building Canada's economy. It is critical that a national policy be adopted to disseminate information and encourage the development of CAD/CAM technology in support of industry."

- "Council recommends to industry that virtually every manufacturing company in Canada should designate at least one person in a technical management capacity within the organization to become aware of developments in CAD/CAM technology -- and to plan the response of the firm to the threats and opportunities that this new technology involves."

"Strategy for Survival". A report to Canadian industry, Educational Institutions and Government by the CAD/CAM Technology Advancement Council, September 1980.

13. This newsletter may be reproduced in whole or in part. Reprinting in other Canadian publications is encouraged. Acknowledgement to the Canadian CAD/CAM Council for the Advancement of Computer Integrated Manufacturing would be appreciated.

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