



CAD/CAM

NEWSLETTER

DEPARTMENT OF REGIONAL
INDUSTRIAL EXPANSION
LIBRARY

APR 21 1986

BIBLIOTHÈQUE
MINISTÈRE DE L'EXPANSION
INDUSTRIELLE RÉGIONALE

April 1986

Information Compiled by the Canadian CAD/CAM Council

for the Advancement of Computer Integrated Manufacturing *

Summary of this Issue

- 1 - A Brief Look at Advanced Robotics
- 2 - Council's 1986 Report
- 3 - ISO Standards Committee: Product Definition Data
- 4 - Book Reviews
- 5 - Conferences, Exhibitions, Workshops and Seminars
- 6 - Twenty New Publications Provide a World View of CAD/CAM
- 7 - CAD/CAM Quotes
- 8 - Newsletter Scheduling

1. A Brief Look at Advanced Robotics

The CAD/CAM Newsletter normally focusses attention on the design and manufacturing applications of computer systems technology, with increasing emphasis on the management of the technology. This section of the newsletter diverges slightly to provide a brief look at advanced robotics. These are developments of a more research oriented nature, which may have application eventually in areas other than manufacturing, but which in some cases will also influence manufacturing applications as well.

Newsletter readers will recall that Canada is a participant, along with approximately eight - ten other countries, in a program for international exchange in advanced robotics. This is one of eighteen technology programs initiated after the Versailles Economic Summit in 1982. While this Group of Eight sponsorship has been concluded, many of the technology cooperative projects, such as the Joint Coordinating Forum (JCF) for International Cooperation in Advanced Robotics, are continuing. Countries involved in the robotics program are Japan, France, Germany, Italy, U.S.A., U.K., Canada, Austria as full participants plus the European Community (EC), Norway and The Netherlands as observers.

Recognizing that the industrial sectors in the countries represented are increasingly developing and utilizing robots, and recognizing that among the areas particularly appropriate for government action and cooperation are advanced robot systems that avoid the need for people to

work in harsh, difficult or dangerous conditions or environments, this forum is promoting activities that will support such development. Advanced robot systems capable of working in the conditions and environments proposed will require new technologies which are far more advanced than those embodied in the industrial robots of today. In order to develop such technologies in the most efficient manner, it has been agreed that international cooperation among developed countries is highly desirable.

Canadian representatives attending the forum meetings and organizing Canadian participation are N. Burtnyk and J. Scrimgeour from the Division of Electrical Engineering, National Research Council.

The forum has identified advanced robotics applications in the following areas:

- space
- underwater
- nuclear
- mining and tunneling
- agriculture
- civil engineering
- plant operations and maintenance
- fire fighting and rescue
- medical and health care
- services and domestic

To date, the JCF/AR has met five times; in Japan, France, Italy, the U.K. and recently in the U.S.A. The essential role of this forum is to organize an appropriate set of activities that will promote and facilitate the desired interaction and cooperation consistent with the national R&D policies and programmes of the participating countries.

Workshops sponsored under this project have been held on the following topics, plus an additional seven scheduled to the fall of 1987.

- Workshop on Fire Fighting and Rescue Robots in Japan, August 1984;
- Advanced Robotics Workshop on System Architecture, Intelligence, and Man-Machine Aspects in Italy, September 1984;
- Workshop on Advanced Robotics in Mining in France, May 1985;
- Workshop on Advanced Robotics for Nuclear Applications in Japan, September 1985;
- Workshop on Sensors and Control for Mobile Robots in USA, April 1986.

To encourage and facilitate international collaboration, NRC has prepared a "Guide to Robotics R&D in Canada" which has been in distribution as an NRC report since September 1985. The report is the result of a study commissioned by NRC and undertaken by robotics

researchers and specialists at the University of Toronto and the Ontario Robotics Centre. By describing robotics research and development at university, industry and government centres across Canada, and encouraging other countries to do likewise, it is expected that the report will encourage collaboration and cooperation to the maximum possible extent, both within Canada and internationally.

Invitations for participation in joint site studies by individuals from participating countries are available as follows:

<u>Application or topic</u>	<u>Country</u>	<u>City or study location</u>
Mining	France	L'Aumance
Nuclear	France	Saclay (near Paris)
Advanced robotics	Germany	Stuttgart
Coal mine manipulators	Germany	Stuttgart
Plant operation & maintenance	Italy	ENEA (near Rome)

There is good indication that the catalytic effect of this international cooperative project in advanced robotics has already raised considerable Canadian interest and discussion in important application areas, such as mining. While this began from consideration of the possible use of robots in mines, this is now widely recognized to be the development of mining automation and remote mining systems rather than the specific application of robots per se.

The first International Symposium on Innovative Mining Systems held at MIT, November 4-5, 1985, while not formally under JCF sponsorship was closely related, and was attended by approximately thirty Canadians, indicating a high degree of interest and willingness to participate.

In response to the U.S.A. proposal to establish a centre for international collaboration in automated mining and tunnelling, a Canadian position and action plan was tabled at the meeting of international representatives November 6, 1985. Briefly this proposal, prepared by the Canada Centre for Mineral and Energy Technology, which is a division of Energy Mines & Resources Canada, proposes the following action:

Should a decision be made to form a working group or an International Centre in the United States of America, Canada, through CANMET, is prepared to collaborate in the form of an exchange of technology, information, data, and scholars. Arrangements could also be made for test sites and industrial cooperation in Canada.

This approach would provide for collaboration in a manner similar to existing arrangements under two Memoranda of Understanding between CANMET and the United States Bureau of Mines (USBM) in two other technology areas.

To facilitate the development of a well-defined national consensus on the present needs for robotics, a Canadian consultative workshop with industry and others, co-sponsored by CANMET/MRL and the Ontario Centre for

Resources Machinery Technology (OCRMT), was held March 12, 1986. The purpose of this workshop was to alert Canadian Industry to these international developments, and provide a basis for understanding Canadian industry needs.

These several events are summarized in a paper to be presented to the Canadian Institute of Mining and Metallurgy, May 11-15, 1986¹. The paper includes a summary of the JCF sponsored International Workshop on Automation of Mining Devices, Paris, May 21-22, 1985 and the above MIT symposium November 4-5, 1985 plus some conclusions from the Sudbury workshop of March 12, 1986.

The recent U.S.A. meeting of the robotics forum included a two day workshop on sensing and control for mobile robots with twenty two technical papers presented by speakers on an invited basis from the participating countries. Most papers described scanning, navigation and control problems in autonomous (un-manned) robots or vehicles which can operate on wheels, tracked vehicles or various forms of legs for those with a walking capability.

A brief summary is given in the list below. All of these projects are essentially of a research nature, to identify problems and test solutions. Results to date are a long way from being robust and in most cases it is therefore likely to be many years before reliable applications outside the laboratory environment will be possible. Analysis and integration of sensor data is a problem in most instances. It is interesting, nevertheless, to be aware of these activities and the directions that are being pursued.

- Japan - Mechanical Engineering Laboratory. The original "MELDOG" a small motorized cart with sonar scanners, power supplies and computer racks. Scans the environment as it moves. Might conceivably be used as a seeing eye "dog" to guide the blind. Tape cassettes hold environment data base etc.
- Automobile with two video cameras and no driver. Can follow highway, and swing out to pass another vehicle or obstacle.
 - Six legged spider like robot with suction cups on each foot can climb the vertical wall of a building.
 - A bi-pod walking machine with "knee-flex" etc. Balances and walks like a human. Must place each foot "in-line" to maintain balance. Currently limited to 5 steps at about 10 seconds per step.
 - Spider like robot "MELWALK" can climb obstacles and stairs. Feelers on each leg and foot determine the location of riser and tread of stairs at each step.

¹ "Recent Developments in Remote Mining Systems", N. Burtnyk, J. Scrimgeour (National Research Council), J.E. Udd, J. Pathak (CANMET). Annual General Meeting, Canadian Institute of Mining and Metallurgy, Montreal, May 11-15, 1986.

U.S.A.- Autonomous Land Vehicle (ALV) - Eight wheeled vehicle for possible off-highway military application. Currently obtains video camera input and identifies roadway to follow by scene analysis and edge detection.

- University of Maryland - A "model railroad" table top 96:1 scale model of the ALV test track. Video camera guided over the "roadway" by a robot is used to test vision and vehicle steering algorithms.
- U.S. Navy - A modified full tracked personnel carrier is used as an autonomous robot. Has ultra sonic scanners and other navigation sensors. Using "blackboard" technique for information handling in computer system.
- MIT - Have autonomous laboratory vehicle with a system architecture which permits a modular addition of functions. Can "wander" through a room of people, avoiding collisions.
- Drexel University - An autonomous "dune buggy" type vehicle. As in others, control software is sub-divided into categories of task planner, navigator and pilot.
- Carnegie Mellon University - Single legged "robots" can hop around the laboratory, maintaining balance and direction. Have piston type leg, like a pogo stick, to produce hopping action. Also have small two legged versions. Scissor shaped legs produce a "road-runner" type of locomotion.

France- Laboratory vehicle in Toulouse has appearance somewhat similar to MELDOG in Japan. Has 16 ultrasonic sensors plus stereo matching video and laser range finder.

U.K. - Warwick University - Small bomb disposal type vehicle guided by sonar scanners and on-board 16 K LSI 11 computer. Now extending to rough terrain route planning and 32 element panoramic sonar scanner.

Germany-University of Karlsruhe - Vehicle with an on-board PUMA robot under development to travel through a factory, picking up appropriate parts for robot assembly.

2. Council's 1986 Report

Work is progressing on the 1986 report of the CAD/CAM Council. The report entitled "Management in Crisis: Implementing Computer Integrated Manufacturing in Canada" is based on the deliberations of the February 1986 workshop as summarized in the February Newsletter.

The report, which is planned for distribution in June, in both English and French, stresses the strategic planning and senior management aspects of CIM.

3. Standards Committee: ISO/TC 184/SC 4

Following the set up of a Canadian Advisory Committee of the ISO Technical Committee on Industrial Automation (CAC/ISO/TC 184), it is now

urgent to form a Canadian Interest Group to survey and review the work of one of its sub-committees, namely Sub-Committee 4 of ISO/TC 184.

Sub-Committee SC 4 is concerned with external representation of product definition data, i.e., digital representation and communication of product definition data for use in computer-aided design, analysis, manufacture, test and inspection. The standard must capture information necessary to compose a computerized product model in a neutral form. This must be done without loss of completeness and integrity. This work goes far beyond the work performed in the IGES project and is going to revolutionize the structure of current commercial CAD/CAM systems. The project is called STEP (Standard for Exchange of Product Model Data) and has its foundations in the PDES project of MCAIR. A first draft of the STEP requirements has been defined and is being circulated for comments.

It is important that representatives of Canadian industries, governments, and universities be aware of this work and participate in order to look over the directions and goals and give their opinion.

Any individual or organization wishing to contribute to this activity is invited to contact the convener for CAC/ISO/TC 184/SC 4.

F. Vernadat
Division of Electrical Engineering, M-50
National Research Council of Canada
Ottawa, Ontario
K1A 0R8

4. Book Reviews

"Robots - Planning & Implementation" - C. Morgan, IFS (Publications) Ltd. U.K., Springer-Verlag 1984, 195 pp., hardcover.

The author, who was affiliated with the University of Warwick in England, has provided a good outline for beginners wishing to understand the implications of robotization. The chapters are grouped into three categories, viz. (a) Defining the need for a robot system and choosing the correct system; (b) Areas which require special attention and (c) five case studies from European industry. The book has presented a practical approach to the selection and installation of robotic systems and has succinctly organized considerable information relating to the technical aspects of robot specification without cluttering up the presentation with jargon. The author has also provided an insight into the peripheral factors which affect such choices, specifically safety and people considerations. Investment appraisal procedures have been highlighted in some detail. Perhaps the most important contribution by the author is a comparative survey of five robot installations in Europe through case studies. The robot applications have been illustrated with facts and figures; problems encountered during the running in phase of the robot systems have been well-identified. Attitudes of workers and unions towards their implementation have been examined. A case example of

financial appraisal of a robot application for a specific industrial component rounds off the information offered in the text.

This book does have certain limitations. It is obviously meant for a beginner and specifically for the industrial manager, rather than for a researcher. It is doubtful if it can be used as a full text at the university level; it will, however, make excellent supplemental reading. The investment analysis will not be totally relevant in the Canadian context because of the use of taxation policies prevalent in the U.K. Also, perhaps, a slightly more detailed description of a robot would have helped. However, in the end, the author needs to be commended for an excellent and authoritative presentation of many facts and figures which will clearly help the industrial manager in decisions involving robotization.

Reviewed by Dr. S.P. Dutta, Faculty member and Industrial Consultant, University of Windsor, Department of Industrial Engineering.

"Robot Vision, International Trends in Manufacturing Technology" -
A. Pugh, IFS (Publications) Ltd., U.K. 1983, 356 pp., hard cover.

Professor Alan Pugh is a well known specialist in the field of robotic vision. Mr. Pugh acted as editor of this book and did an exceptional job at selecting the best articles and papers out of a massive collection of publications.

The book is excellent as a reference manual for individuals involved in robotic vision/inspection. It is not suitable as a classroom textbook. There are no actual problems and solutions available for exercises although specific problems and underlying theory behind problems are well explained.

The book is actually a collection of good publications and each are appended with references. The book is composed of both technical information as well as easy readable vision applications and uses.

The technical content of the book is mainly aimed at university or research oriented people, while the application content satisfies the needs of industrialists as well as the research population. It is not recommended for management, but it is recommended to the managers' right hand technical advisors.

The book is very complete and up-to-date considering the rapid change in technology. It can be read without other manuals because it is composed of a collection of papers with the proper references if required.

The book is highly recommended to professors and engineering libraries, as a reference manual for students/professors/researchers, and as an application guide for industry.

Reviewed by G. Senechal an employee of the Manufacturing Technology Centre in New Brunswick. His master's degree program included a project in designing and implementing a vision system to a work cell.

5. CAD/CAM Conferences, Workshops, Exhibitions and Seminars
(See also previous listings, including the list of major 1986 CAD/CAM conferences provided in the January issue.)

- "IMTS 86 - International Machine Tool Show"
Sept. 3-11, 1986, Chicago, Illinois.

This very large scale display of manufacturing technology and equipment is held every two years in Chicago. IMTS 86 is more than one-third bigger, with over 2 million square feet of exhibit space for the more than 1000 exhibits from over 30 countries. More than 200 papers in 100 technical sessions are scheduled for the conference portion.

Early registration for either the exhibition show or conference is recommended.

Contact: National Machine Tool Builders' Association (NMTBA)
7901 Westpark Dr.
McLean, VA 22102-4269, U.S.A.
Telephone: (301) 662-9412

- "CAD/CAM 86"
Sept. 16-18, 1986, Palais des Congrès, Montreal.

The CAD/CAM Association, in conjunction with the widest possible consensus of professional and sectorial associations representing the majority of industry and users of high technology, is again this year organizing CAD/CAM 86 - a major technology event of the year, at the Palais des Congrès in Montreal (Montreal Convention Center) on the 16, 17, and 18 of September 1986.

Authors of proposed papers are requested to submit abstracts of not more than 200 words, accompanied by a CV of equal length, prior to June 15, 1986.

Contact: CAD/CAM - 86
c/o Louise Renaud
D'Avirro & Ass.
1440 Ste. Catherine Street West, Suite 701
Montreal, Quebec
H3G 1R8
Telephone: (514) 879-9037

- "Third Annual International Forum on Micro-Based CADD"
Sept. 17-19, 1986, Colorado State University, Fort Collins CO, U.S.A.

This three day forum on micro-based, computer aided design and drafting (CADD) will focus on leading software, including AutoCAD, CADKEY, CADVANCE, Cascade, Cubicomp, MegaCADD, P-CAD, RoboCAD, Versa CAD, Anvil 1000 MD, Personal Designer and others including a sponsor's showcase of hardware and software.

Contact: Office of Research, Development and Training
Department of Industrial Sciences
Colorado State University
Fort Collins, CO 80523, U.S.A.
Telephone: (303) 491-5278

- "Southern Manufacturing Technology Show (SMTS-87)"
Jan. 26-29, 1987, Charlotte Convention Center, Charlotte, N.C.

The first regional satellite version of the well known Chicago IMTS Show (see above) will be held in January 1987 as indicated.

Contact: Mr. Elwood Hasemann
Exhibition Director
National Machine Tool Builders' Association
7901 Westpark Drive
McLean, VA 22102, U.S.A.
Telephone: (703) 893-2900

6. Twenty Selected Abstracts Provide a World View on CAD/CAM

For a monthly review of CAD/CAM developments around the world please refer to the selection of twenty abstracts in the section attached. These will assist your organization to meet both the management and technical challenges of computer integrated manufacturing.

While the abstracts provided are informative in themselves, in most cases copies of the complete papers can be obtained from your nearest technical library, or from the Canada Institute for Scientific and Technical Information (CISTI), which is part of the National Research Council, as noted.

7. CAD/CAM Quotes

- "There is a need for a substantial increase in general awareness and technical knowledge of CAD/CAM technology by both management and technical personnel in Canadian industry.
- There are few technically qualified personnel that understand CAD/CAM systems; there is a shortage of highly qualified manpower.

- Approximately 20% of the 10 million people in the Canadian labour force are employed in the manufacturing industries. If 10% of this 2 million people require at least an introductory knowledge of CAD/CAM systems technology, as a minimum, the number of people involved is 200,000.
- Industrial films and documentaries illustrating successful applications of CAD/CAM technology should be encouraged, and if necessary, financed by the federal government."

From the CAD/CAM Council reports "Strategy for Survival" 1980 and "Closing the Gap", 1983.

- "One important task when defining the technical and economic objectives of the project is of course to ascertain carefully whether there is really a need for a full FMS or whether an FMC [flexible manufacturing cell] would suffice to begin with. Many companies which have invested in FMS subsequently realized that the complexity of the system was far greater than anticipated. In this context, the following recent statement by a manager of a leading machine-tool company is illustrative: "What we're seeing really is some rethinking. People are beginning to recognize the complexity of these full-blown systems, and they're having second thoughts. They look at the complexity, the dollar investment, and they're looking at their needs. Many companies can't handle an FMS - certainly the smaller ones can't. So, they're looking to something else, and that something is the cell."

From "Recent Trends in Flexible Manufacturing" United Nations (Economic Commission for Europe) 1986.

8. Newsletter Scheduling

While preparation of this April issue in camera ready form is proceeding to meet the normal month end deadline, one is aware that the January, February and March editions have not yet been issued. The CAD/CAM Council is aware of this delay and are advised by the Council secretariat that it is largely due to delay in translation. We apologize to our readers as this makes it difficult to provide them with up-to-date information in as timely manner as desired. According to current CBC news reports, 82 translators in the Secretary of State, which provides language translation services to other government departments, have been declared surplus in the current staff reductions. The CAD/CAM Newsletter was formally issued regularly on or before month end, and at a recent council meeting members expressed a desire to return to this as closely as possible.

9. This newsletter may be reproduced in whole or in part. Reprinting in other Canadian publications is encouraged. Acknowledgement to the Canadian CAD/CAM Council would be appreciated.

* Secretariat

Canadian CAD/CAM Council
Office of Industrial Innovation, 5th Floor Centre
Department of Regional Industrial Expansion
235 Queen Street
Ottawa, Ontario K1A 0H5

** Newsletter Editor

J. Scrimgeour
Bldg. M-16
National Research Council of Canada
Ottawa, Ontario K1A 0R6

Please note that requests for additions, deletions or changes to the newsletter distribution list should normally be directed to the secretariat.

