# CAD/CAM IN LABORATORY

With a generous donation of HK$1 million from Elite Industrial Holdings Ltd., and a contribution of HK$1½ million from Hong Kong Polytechnic's funds, an advanced CAD/ CAM laboratory was started in August last year. Called the Elite CAD/CAM Laboratory, it was established to fulfill the need for a good teaching laboratory for a degree course to be started this year, called Manufactural Engineering, which places great emphasis on CAD/ CAM control and automation. The establishment of this CAD/CAM laboratory is also to create an infrastructure to do research into applications for CAD/CAM systems and to provide operating training for engineers.

Dr. K.V. Patri, Principal Lecturer at Hong Kong Polytechnic's Production and Engineering Department, who also heads the Elite CAD/CAM Laboratory, had talked to HKPC about the CAD/CAM laboratory and his experience in using CAD/CAM systems.
Dr. K.V. Patri gained his Ph. D. at Manchester University, England. In 1978 he came to Hong Kong and joined the staff at Hong Kong Polytechnic. He is also a member of a CAD/CAM subcommittee of the Industry Department.

**Q. Dr. Patri, what equipment is installed in the laboratory?**

**A.** The major equipment includes a Computervision Designer V-X System with one colour and one monochrome workstation, supported by software for 2D/3D mechanical and production design, N.C. programming, robot simulation, nesting, advanced surface design, etc. There is one Tektronix and one VAX workstation linked to the computer centre's VAX system: one CNC Mitsuiseiki VR3A machining centre, one CNC Equero Nucpal Lathe, one Bridgeport mill/drill, two Move Master teaching robots, one Puma 760 robot, and assorted microcomputers and other equipment. In addition, we also connect to the Hong Kong Polytechnic computer.

**Q. Why was this equipment selected?**

**A.** This department is an Industrial Production Department and therefore we are primarily interested in CAM. I personally think of it as a CAM/CAD laboratory rather than the reverse CAD/CAM. We look at integral manufacturing, not separated islands, but we cannot have full CAM without a good CAD base. In other departments at the H.K. Poly. there is a lot of CAD, but to me CAD needs real time information passing between CAD and CAM. In the laboratory we are looking at a group of NC machines which form an integral cell, and not just a single NC machine. We aim to teach our students how to overcome problems associated with making a group of machines automatic through the use of computer communications, utilizing robots to load, unload, orientation, transporting and inspecting work pieces. The philosophy is that when you are looking for vendors around the world, you want to have a full CAM and not just a CAD for design.

When we created the laboratory, we did not want a good automatic factory, we wanted a facility in which to investigate automatic factories, and therefore we purchased the basic equipment which has the potential to turn into a good integral CAM system. On this basis we selected the most cost-effective equipment. Of course, more money would buy a better system.

**Q. Will you give us your definition of CAD/CAM?**

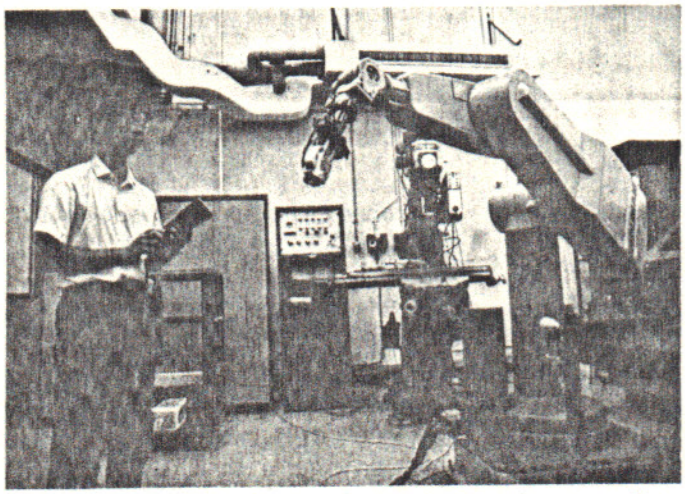
**A.** As I see it, CAD/CAM is only part of CIM (Computer Integrated Manufacturing). CA means computer aided and we now have CAD, CAM, CAI (Computer Aided Inspection), CAPP (Computer Aided Process and Planning) etc. They are not integrated to form a huge computer and the most important thing is the integration. In education, a lot of emphasis is placed on that.

**Q. Will there be any further developments in CAD/CAM laboratories?**

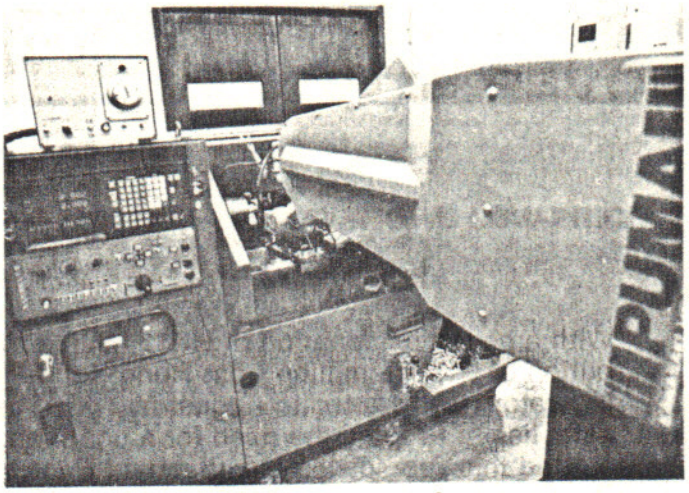
**A.** Buying the machines is only the starting point whereas putting the things together constitutes development. The laboratory facilities will help us to understand new technologies and tackle problems. Over the next three years there will be a period of consolidation and utilization. Of course, we will add some accessories, such as sensors and small CNC machines, but we will have expansion in terms of work, rather than in terms of machines.

**Q. How much time can each student spend in the CAD/CAM laboratory?**

**A.** Actually, in terms of time, the CAD/CAM is fully used. On average, Higher Diploma students spend only 25 hours



**A laboratory staff member demonstrates the operation of a Puma 760 robot.**




**The robot and a CNC lathe at work.**

planned study in CAD/CAM in a three year period, but project students, who are the principal users, spend as much as 200 extra hours on CAD/CAM. Bearing in mind that the facility is a laboratory, rather than a factory, I should add that only 50% – 60% of available CAD is actually utilized.

**Q. What research is being undertaken in the laboratory and how successful is it?**

**A.** Several research projects are currently underway including assembly using a robot, direct neumatic control, development of flexible machinery cell (FMC), development of software for post-processor building sub-system, etc. Considering the laboratory has only been open for six months and research is being undertaken by Higher Diploma students, we feel that achievements are satisfactory, and we expect to see even faster progress in the future.

**Q. What training approach is used?**

**A.** Teaching is divided into three basic modules. Appreciation – which involves getting students down to the lab to teach them how to design by using CAD, and how to operate a robot. Solving small tasks – by letting students tackle smaller problems, e.g. assembling one component to another. Major project – these are undertaken by final year students, e.g. developing subsystems, inspection station.

**Q. From a broader point of view, what problems are likely to be encountered if one wishes to install CAD/CAM in a factory?**

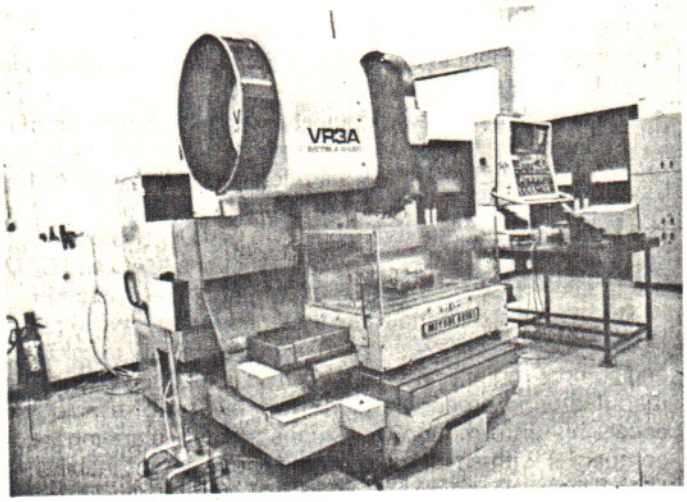
**A.** The problems are quite similar to the ones we face in our laboratory. The biggest problem is the quick obsolesence of equipment which makes it necessary to continuously update machinery and work done to maintain the level of the system. Also, running a CAD/CAM laboratory is group work which cannot be done by just one man since it requires a wide variety of expertise such as mechanical, electronic and electrical engineering, computer science and higher mathematics. Each specialization must co-operate with and complement the other, which is not easy to achieve. As far as our laboratory is concerned, so far we have extracted a group from within our own department to run CAD/CAM, but in a second phase we must tie in to other departments at H.K. Poly. Projects assigned to students should be linked together and lead to overall goals, which is a question of 2 – 3 years forward planning, involving lengthy and complex work. In applying a new CAD/CAM system to industry, a change in organization and management techniques is essential to achieve greater cooperation between various departments, otherwise a loss could be incurred and the system's capacity will not be fully utilized. Sending staff overseas for training is necessary and this can create additional problems.

**Q. What type of person makes a good CAD/CAM specialist?**

**A.** I don't think anybody can answer that question yet, but we will use our laboratory to find an answer. Certainly a CAD/CAM specialist must be knowledgeable in a variety of fields, but it is impossible to train a 'super-engineer' who is an expert in everything. What we intend to do is develop an individual who is familiar with a number of disciplines and can communicate intelligently with experts across the field. If we succeed, our graduates will act as middle-men who can communicate with the experts when a specific problem is identified. I do want to emphasize that the more advanced the technology, the greater is the need for co-operation and integration among different fields.

**Q. Are the capabilities of CAD/CAM being overlooked by Hong Kong industrialists?**

**A.** Yes – and I don't know why a place as dynamic as Hong Kong is so slow in responding to CAD/CAM. In England and Singapore, government plays an active role in promoting the use of CAD/CAM, but in Hong Kong, government seems to stick to the theory that industry will help itself if it needs something. Actually, industry does need professional advice, like that obtainable from HKPC, and discussions concerning CAD/CAM only started last year.




**A CNC Mitsui Seiki VR3A machining centre.**

**Q. In your opinion, what will be the future trends for CAD/CAM in Hong Kong?**

**A.** There is definitely demand pressure to move Hong Kong industry into CAD/CAM. Production is moving toward high-end products where short response time is important, and CAD/CAM power cannot be neglected. Certainly CAD/CAM will come to Hong Kong this decade. In addition, some cheaper systems for specific usage will be available to further enhance the versatility of CAD/CAM.

**Q. Is it likely that the development of CAD/CAM will put small scale industry out of business?**

**A.** On the contrary. According to research undertaken by Japan Productivity Centre, CAD/CAM will actually help small businesses compete with large factories. In the past, small factories could not produce high-end, quality products, but once CAD/CAM is installed, productivity will be enhanced enabling small business to compete in terms of quality and time.

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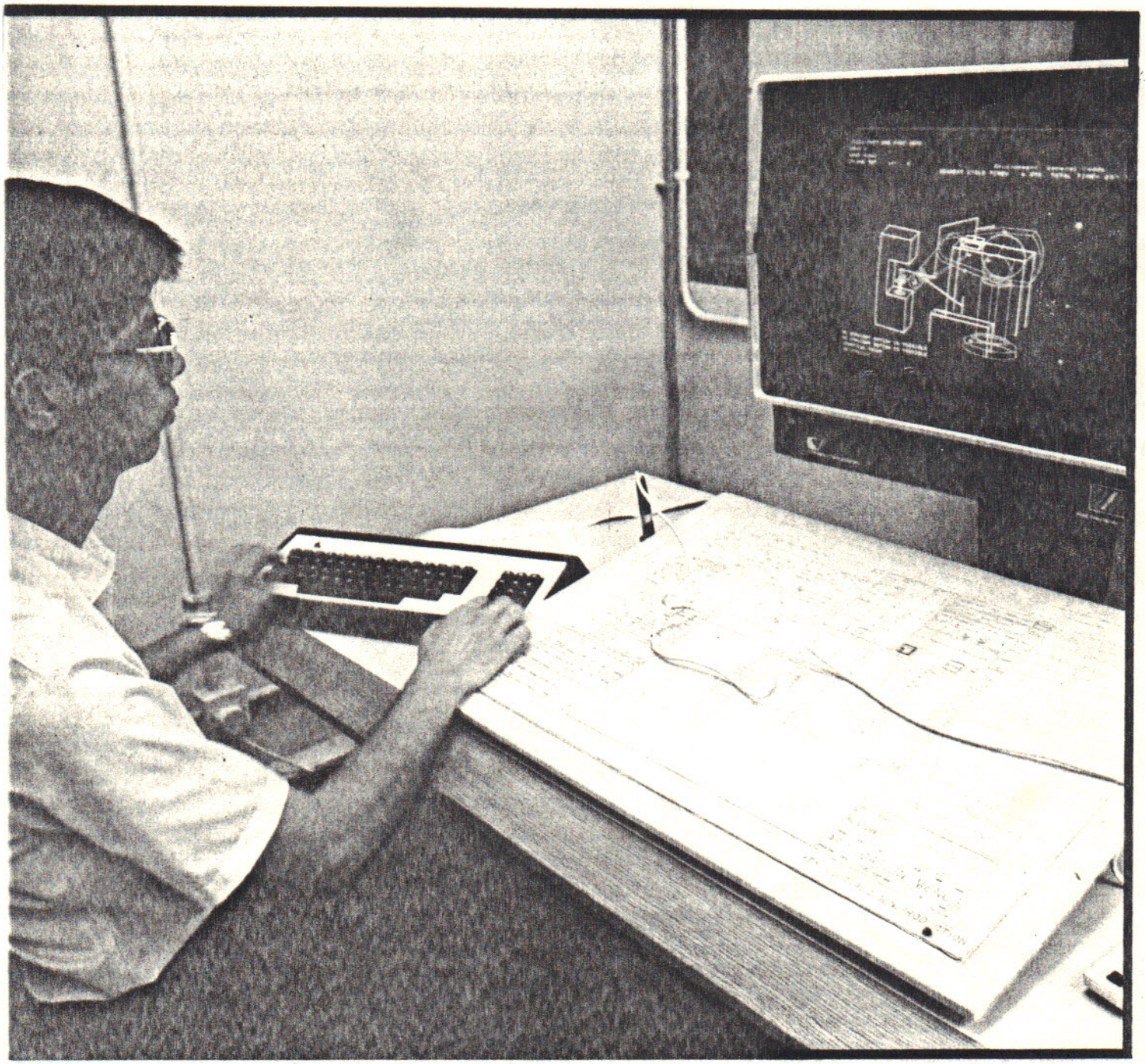
# ELECTRONICS BULLETIN

July 1985

## Interview: CAD/CAM In Laboratory



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