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The leading scientific publishing company, Academic Press in London, has entrusted Prof. Bruno Buchberger, head of RISC-LINZ, with the publication of this first international scientific magazine devoted to symbolic computation. This means that the latest scientific findings in the field of symbolic computation from all over the world will first be passed on to Linz.

The international acclaim for the basic research work carried out at RISC-LINZ is the motor of all the other activities and forms the basis of the attraction that the institute has for research scientists all over the world. Graduates from the institute are sought after everywhere, and industrial firms have started to take notice of RISC-LINZ as a partner for cooperation in the field of technical software.

"Industrial innovation is closely connected with the automation of problem-solving. The aim of Symbolic Computation is to automate the technical process of problem-solving on a higher level and thus to relieve technicians, engineers, mathematicians and computer scientists of a good deal of the purely mechanical tasks, so that they will be able to concentrate on the creative aspects of their work," Prof. Buchberger describes the opportunities which lie in cooperation between industrial firms and his institute.

Symbolic Computation, a promising branch of mathematics and computer science, is not confined to schematic numerical calculations. It is mainly a way of carrying out operations on the computer with non-numerical ("symbolic") objects such as logical formulae, equations and mathematical "letter expressions", or with computer programmes. This means that larger and larger areas in the fields of rational, technical and mathematical problem-solving will be computer-aided and partially automated. Symbolic Computation thus forms the basis of applications in almost all modern fields of software, such as CAD/CAM, robot programming, expert systems, functional and logical programming, computer-aided programming systems and so on.

The results of the research work carried out at the institute are being practically applied in a series of joint projects with industrial



FOTO: SCHEPPE

RISC-LINZ SYMBOLIC COMPUTATION

"There is no facility in the United States comparable to RISC-LINZ", it says in a study called "On the Future of Symbolic Computation" which was published by the National Science Foundation, the foremost research institution in the United States, at the beginning of this year. In the same study the Journal of Symbolic Computation has been called the "primary journal" in this field.

firms, some of which are particularly notable:

- A project being carried out in collaboration with the firm AIS dealing with basic problems in the off-line programming of robots. The whole action sequence can be precalculated in robot cells in the computer and simulated on the screen. The complete robot code can be thoroughly tested before use, and this avoids time wasted through reprogramming, inactivity or collisions.
- In a project with the firm Mayr-eder a software control and simulation system for the complex equipment used in tunnel-drive units is being developed.

- The application of expert systems in the process control of large plant, such as cement works or steel-casting foundries, is the focus of a project with VOEST-Alpine ETA.
 - In a project with the university software firm Uniware the creative work of the chemists in the synthesis of molecules is backed up by a multilayer expert system.
 - The development of a language for the parallel programming of transputer-based hardware constitutes a further interesting project.
- With all these projects Prof. Buchberger stresses that RISC-LINZ carries out only the research work. The routine work necessary

for the practical application of the results of the research work is carried out by staff of the firm under the supervision of a project director provided by the RISC. "A research institute is not a commercial enterprise. Making a profit is the business of the partner firms. RISC is responsible only for the research part which the firm cannot carry out with its own resources, and then maybe also for the organization of the project," says Prof. Buchberger, thus drawing sharp borderlines from the start.

The firms, however, profit from their cooperation with RISC-LINZ not only in terms of the product in question, but also in terms of competitiveness and general know-how. In addition they often gain access to research programmes (Eureka, Esprit) and international cooperative ventures which, without the international contacts of RISC-LINZ, would have been unattainable for them. In terms of training RISC-LINZ offers a programme of studies consisting of about 40 courses with the emphasis on Symbolic Computation.

Since last spring RISC-LINZ has been housed in medieval Hagenberg Palace whose renovation was financed by the Province of Upper Austria. The fact that RISC-LINZ has moved into the palace does not, however, mark the end of a development but, on the contrary, a beginning. Prof. Buchberger outlines new objectives: "RISC-LINZ regards itself as a focus for a future team of firms and institutes working in research and development in the software field."

- The costs for staff, computer equipment and infrastructure are equally shared between
- state authorities, especially the Federal Ministry of Science and Research, the Province of Upper Austria, the Linz Municipal Authority, the Chamber of Commerce of Upper Austria, and the Linz University Education Fund;
 - funds for scientific research promotion: FWF, FPF, EUREKA, ESPRIT and
 - industrial entities.

RISC-LINZ thus covers a good deal of the costs through its own activities and projects. It was therefore easy for Federal Minister Erhard Busek in his opening address on October 28th 1989 to pay tribute to the significance and the exemplary role of Prof. Buchberger and his institute.