

FOREWORD

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In recent years, with the sophisticated information society of the 21st century no farther than a few years away, the progress of information systems is indeed eye-opening in all areas of society in Japan, not to mention the manufacturing sector. In considering numerous benefits of computer technology we enjoy in our steel industry, it is no exaggeration to say that steel comes atop among all industries. Steel's rebirth from the wartime devastation to its expansion today parallels the history of computer technology in its sprouting, growing and development. In its thirty years of history of computer utilization, the Japanese steel industry has regularly introduced leading edge computer technology, promoting the construction of information processing and process control systems for the production of steel. Since 1980, the development and application of large scale systems, particularly for real-time information processing, and a number of high-level process control systems have contributed to improved product quality and reduced costs in steel production.

On the other hand, this type of system expansion highlighted a number of problems, and the calls for new breakthroughs became urgent. One problem in need of solution is a need of improved productivity to meet the expansion of software in an exploding volume of software requiring development and control in recent years. Second was an expanded range of applications in higher level process control functions. The main objects of control until recently had been quantitative processes which were expressed by physical models, such as for converters, rolling mills, and reheating furnaces. In other processes such as for blast furnaces and materials flow, experiences and individual factors played decisive roles, and the processes were difficult to quantify. The systems development of these operations was postponed, and automation lagged in some areas. Third, although mathematical planning methods such as OR were used to some extent in such planning problems as raw materials allocation and production planning, drastic changes in the production and operating environment in many cases required improvised solutions devised by experienced operators. How to cope with planning-type problems requiring expert knowledge, and further, with non-regular processing needs which had been virtually impossible for systems development thus became essential tasks.

Kawasaki Steel Corporation considered artificial intelligence (AI) methods to be one effective approach to solve these three problems, and has up to the present promoted the development of a number of systems. The rule-type control system introduced in 1984 for material flow control in the finishing process at Mizushima Works Billet Mill was the first real time-type expert system in the world. Thereafter, in July 1986, a Systems Research Section was set up in the Head Office in order to broaden the use of AI methods and establish development methodologies. The fruits of these efforts include the developments of more than 50 systems company-wide. This special issue presents representative examples of recently developed systems.

It may now be said that AI has advanced from the trial stage to the stage of practical appli-

cation. However, with both the effectiveness of expert systems and their practical problems and limitations becoming more evident, it is important to make a proper distinction between problems which should be solved by the refinement of conventional control algorithms and those which should be solved by AI techniques. In other words, what is required is a well-balanced marriage of AI and existing techniques (mathematical engineering, control engineering, etc.). These technologies are expected to make a major contribution to computer integrated manufacturing (CIM) in the steel industry from the latter half of the 1990s into the 21st century. We will therefore strive to expand our group of AI specialists and will actively pursue solutions to new problems.

In closing, the AI technology sector is sincerely grateful to many research bodies, including universities, and manufacturers in the electrical and information industries which have provided guidance and cooperation in many areas, and looks forward to the unreserved comments and criticisms of the readers of this special issue.