

Industrial Robots

Tuesday, September 28, 1982 through Thursday, September 30, 1982
Johannes Kepler University Linz

INDUSTRIAL ROBOTS

Opportunities, Prospects and Consequences for Economy, Industry, and Society

International Symposium of the Austrian Society of Informatics (OGI) in conjunction with the Linz Special Events Planning Corporation (LIVA) and the Austrian Broadcasting Corporation (ORF) - regional studio for Upper Austria.

Program Committee:

Prof. Dr. Christof Burckhardt, Lausanne
Oberingenieur Adolf Hörl, Friedrichshafen
Dr.-Ing. Rolf D. Schraft, Stuttgart
Univ.-Prof. Dr. Arno Schulz, Linz
Prof. Dr.-Ing. Hans-Jürgen Warnecke, Stuttgart
Prof. Dr.-Ing. Hartmut Weule, Sindelfingen
Univ.-Prof. Dipl.-Ing. Dr. Josef Wohinz, Graz
Dipl.-Ing. Dr. Burkhard Zimmermann, Linz

Tuesday, September 28, 1982, 9:00 a. m. to 6:00 p. m., Johannes Kepler University (lecture-halls 1 and 2)

Topic of the day: STATE OF ROBOT TECHNOLOGY

8:00 a.m. (foyer): Registration
9:00 a.m. (lecture-hall 1): Opening Session

LECTURES

9:30 a.m. (lecture-hall 1):
Dr.-Ing. Rolf D. Schraft (IPA Stuttgart), Industrial Robots - State-of-the-Art, New Fields of Application, Limits to Automation

10:30 a.m. (lecture-hall 1):
Prof. Dr. Christof W. Burckhardt (ETH Lausanne), Survey of Today's Industrial Robots

11:15 a.m. (lecture-hall 1):
Dr. Winfried Schenk (Investitionskredit Wien), Industrial Robots - an Opportunity for Austria? (Economic Significance of Robot Application)

4:45 p.m. (lecture-hall 2):
Ichiro Kato (Waseda University, Tokyo), State-of-the-Art and Trends in Robotics - Japanese Point of View

GROUP SESSIONS

1:15 p.m. (lecture-hall 1):

Software and Programming of Industrial Robots (Prof. Dr. Christof W. Burckhardt, Lausanne)

1:15 p.m. (lecture-hall 2):

Today's Market - Examples I (Dipl.-Ing. Dr. Burkhard Zimmermann, Linz)

3:45 p.m. (lecture-hall 1):

Sensors for Industrial Robots (Prof. Dr. Christof W. Burckhardt, Lausanne)

3:45 p.m. (lecture-hall 2):

Today's Market - Examples II (Dipl.-Ing. Dr. Burkhard Zimmermann, Linz)

8:00 p.m. (Kongreßsaal /Arbeiterkammer):

Lecture: Methods of Management and Trade Union Policy in Japan

Shigeru Shinomiya (Executive Vice President, Honda Motor Company, Tokyo)

Taizo Ueda (Managing Director, Honda Foundation, Tokyo)

Dr.-Ing. Rolf Dieter Schraft

Rolf D. Schraft (born in Stuttgart in 1942) studied mechanical engineering at the University of Stuttgart and graduated there in 1976 with a thesis on "Systematic Selection and Design of Programmable Manipulating Equipment". Since 1969 he has worked for the Institut für Produktionstechnik und Automatisierung (IPA -Institute for Production Technology and Automation) of the Fraunhofer-Gesellschaft in Stuttgart and has been its Deputy Director since 1976. Dr. Schraft also lectures on automation technology at the Universities of Stuttgart and Dortmund.

Industrial Robots - State-of-the-Art, New Fields of Application, Limits to Automation

Industrial robots have been known in industry for some twenty years. Notable application of industrial robots in Europe started in the early seventies. By now, about 7000 industrial robots are in operation in Europe.

When they were first introduced, industrial robots carried high hopes as they were expected to close the still existing gap in the automation of production technology, i.e. the handling technique. Ten years of application have meanwhile proved that progress varies as to the various fields of application.

Looking ahead for new potential applications, we find application may be possible in various fields besides the metal-processing industry. These however, require additional sensory capacities which at the present state of technology are beyond feasibility.

Prof. D. Christof W. Burckhardt

Christof W. Burckhardt (born in 1927) studied physics at the Swiss Federal Institute of Technology (ETH) in Zurich. Having graduated from the University of Berne, he was with the Batelle Institute in Geneva from 1955 to 1965, then at the University of Illinois/USA, and from 1966 to 1970 he was Managing Director of Test AG in Geneva. Since 1970 Prof. Burckhardt has been head of the Institute for Precision Technology at the Swiss Federal Institute of Technology in Lausanne with the emphasis on industrial robots, sensor technology, and medical technology.

Dr. Winfried Schenk

W. Schenk (born in 1944) studied political science at the University of Vienna majoring in economic subjects and in 1974 he graduated with a thesis on "Models for the Diffusion of Technological Progress". From 1970 to 1981 he worked as an industrial consultant for the Austrian Institute of Economic Research in Vienna. In 1981 he was Visiting Fellow with the Science Policy Research Unit of the University of Sussex.

Main areas of work: empirical industrial economy, diffusion of new technologies, employment effects of technological progress, economic aspects of microelectronics, topics of technology and innovation policy. Since autumn 1981 head of the Department of Economic Policy of the Österreichische Investitionskredit AG, Vienna.

Industrial Robots - an Opportunity for Austria? (Macroeconomic Significance of Robot Application)

Automation of production processes by programmable manipulators has lost its utopian air within the last decade and has become an economically significant branch of industry. Producers of industrial robots have turnovers at the rate of billions, application is possible in many fields. Industrial robots originally designed as a means for curbing rising costs of labour, especially in mass production (e.g. automobile industry), are making their way into small-scale production and are opening up the world of "flexible automation" for small and medium-size enterprises.

Partly due to the structural make-up of Austrian industry and partly due to a wide-spread general fear of innovation, Austria is not in the front line of robot application. Industrial production of industrial robots has been started only recently.

Nevertheless, Austria seems to be able to catch up quickly by specializing in certain lines of development in robot technology. By the cooperation of producers, users, and economic authorities, Austrian robot development has been concentrating on the following areas: simple and robust universal systems allowing unit construction, automation of "custom-made" production and, last but not least, automation with regard to safer and more humane jobs.

Mr. Ichiro Kato

Ichiro Kato is professor in the Department of Mechanical Engineering, and Dean of the Graduate School of Science and Engineering at the Waseda University, Tokyo.

Chairman of numerous international conferences, Prof. Kato is an authority on robotics of international reputation. He is honorary editor of "Mechanism and Machine Theory".

State and Trend of Art of Robotics seen from a Japanese Point of View

Japan's share of industrial robots amounts to approximately 60 to 70 percent of the world total robot population. Shortage of labor forces during the last decade and a change of values in society from one that took pride in efficiency to one that attaches importance to man's welfare, are major reasons that enabled Japan to become a world leader in developing and using industrial robots. Whereas Japan's current robot technology is not very different from that of the U.S., obvious differences exist in history, society and culture.

Japan has not had a long history in which men have been threatened by machines, whereas a fear of machine's dominance over men's work has been deep-seated in the subconsciousness of Western society. Moreover, the soft structure of Japan's society and its inherent flexibility have been conducive to Japan's entry into the robot age. Even the Japanese language and religion seem to be related to the robot situation.

In the next 5 or 10 years so-called intelligent robots will appear which function upon macro instructions from their operators and can feedback information to them. Robot movement will become more and more dynamic and approximate to man's movement. By the 21st century, robots will even penetrate the service industry serving as assistants or supplements of men. (Robots are already being introduced into the medical treatment service area in Japan. Artificial arms and legs -quite similar to prostheses -are now being developed for robots.)

We are now entering a new society, the CYBOT society where cyborgs and robots exist symbiotically with men. In twenty years robots will become so common around us that many will be referred to in the possessive sense as "my robot". The problem of how to establish harmonious relations between man and machine will become even more serious. Since technology has developed and stimulated society and thought (rather than thought having produced technology), in a CYBOT society the social structure must be changed. This presupposes that society is soft or flexible.

Mr. Shigeru Shinomiya

Shigeru Shinomiya graduated from the Faculty of Engineering of the Shizuoka University in 1945.

At present he is Vice-president of the Honda Motor Comp., Ltd. and holds several important positions besides. He is currently Director of the International Association of Traffic and Safety Science, Director of the Honda Foundation, Director of the International Education Center, and member of the International Federation of Automatic Control (IFAC).

Mr. Taizo Ueda

Taizo Ueda graduated from the Osaka University of Commerce in 1953.

From 1962 to 1966 he was Administrative Manager of Honda Motor Co. in Belgium. He has held positions as General Manager of the export, parts and components, car marketing, and public relations divisions, having served several years with each division respectively. He also edited "Business and Society in Japan", published by Praeger Publishing Co., New York.

He is now the Managing Director of the Honda Foundation, Tokyo.

Wednesday, September 29, 1982, 9:00 a. m. to 6:00 p. m.,

Johannes-Kepler-University (lecture-halls 1 and 2)

Topic of the day: ECONOMIC EFFECTS AND APPLICATION REPORTS

LECTURES

9:00 a.m. (lecture-hall 1):

Alfred Dallinger (Federal Minister for Social Administration), Development of Technology and Social Progress

9:45 a.m. (lecture-hall 1):

Prof. Dr. Ing. Hans-Jürgen Warnecke (University of Stuttgart), Industrial Robots - a Means for Flexible Automation

11:00 a.m. (lecture-hall 1):

o. Univ.-Prof. Dipl.-Ing. Dr. Josef W. Wohinz (Technical University of Graz), Application of Robots: Microeconomical Aspects

GROUP SESSIONS

1:15 p.m. (lecture-hall 1):

Industrial Robots for Welding and Spray Painting (Prof. Dr. Ing. Hartmut Weule, Sindelfingen)

1:15 p.m. (lecture-hall 2):

Industrial Robots for Assembling (Oberingenieur Adolf Hörl, Friedrichshafen)

3:45 p.m. (lecture-hall 1):

Industrial Robots for Material Handling and Treatment (Prof. Dr. Ing. Hartmut Weule, Sindelfingen)

3:45 p.m. (lecture-hall 2):

Humanization of Working Life by Use of Industrial Robots (Dr. Ing. Rolf D. Schraft, Stuttgart)

Alfred Dallinger, Federal Minister for Social Administration

Born in 1926

1940 enters professional life, trained as a pharmacist

1946 active in the youth movement of the Trade Union of Employees in Private Enterprise

1948 starts his full-time work for the Trade Union: Secretary for Youth Matters of the Trade Union of Employees in Private Enterprise, functionary of the Austrian Trade Union Youth Organization

1955 leaves the Youth Organization to be nominated Managing Secretary of the Insurance Section

1966 Assistant General Manager and Secretary General of the Trade Union, Assistant Director of the Superannuation Fund of Employees

1968 - 1980 Director of the Superannuation Fund of Employees

since 1974 Member of Parliament

since 1974 Chairman and Managing Director of the Trade Union of Employees in Private Enterprise

since 1975 Vice-President of the Association of Austrian Trade Unions

since 1980 Federal Minister for Social Administration

Development of Technology and Social Progress

Prof. Dr. Ing. Hans-Jürgen Warnecke

Hans-Jurgen Warnecke (born in Brunswick, Germany in 1934) studied mechanical engineering at the Technical University of Brunswick (doctorate in 1963). From 1959 to 1965 at the Institute for Machine Tools in Production Technology at the Technical University of Brunswick. From 1965 to 1970 Managing Director of Central Production Planning of the Rollei Works Franke & Heidecke, Brunswick. Since 1971, professor and Managing Director of the Institute of Industrial Production and Operation at Stuttgart University. Director of the Fraunhofer Institute of Production Technology and Automation, Stuttgart, as well as provisional manager of the newly founded Fraunhofer Institute for Work Economics and Organization.

Member of the board of numerous national and international scientific societies and publisher of scientific publications in the field of production technology and automation.

Industrial Robots, a Means for Flexible Automation

The situation of the manufacturing industry is characterized by an increasingly frequent change of products, a large variety of models, and the necessity of customer-oriented production. The resulting demand for major flexibility in the area of manufacturing is met more and more by industrial robots as a means for automation.

Greatly improved units and control techniques as well as a considerable increase in reliability of the units make industrial robots a flexible instrument of automation for many industrial areas.

The flexibility of the robots as such is limited in some application areas due to the lack of flexibility in peripheral devices, such as grippers, sorting and feeding units, etc., and by the lack of sensors. Present studies and developments in this field suggest possible solutions to that problem.

Univ. Prof. Dipl. Ing. Dr. Josef W. Wohinz

Josef W. Wohinz (born in 1943) completed his studies of industrial and mechanical engineering at the Technical University of Graz. From 1965 to 1973, he was scientific assistant at the Institute for Industrial Economics and Industrial Sociology (Univ.-Prof. Dipl.-Ing. Dr. Max Pietsch). During this time graduation (degree of Doctor of Technical Sciences) and habilitation for Industrial Engineering. From 1973 to 1979 he worked in industry, finally as department manager for Technical Efficiency and Organization with a multi-national electronics company in Vienna.

Since 1979 he has been professor for Industrial Management and Innovation Research at the Technical University of Graz. Both his teaching and research work stress general questions of industrial management and successful realization of industrial innovation projects. His main concern is how to overcome the discrepancies between theoretically established findings and practice-oriented implementation.

Application of Robots: Microeconomical Aspects

Every future-oriented project intended to cause a change of existing structures must be evaluated under three criteria: technical feasibility, economical expediency, and social acceptance. The industrial innovation of a robot application constitutes such a change of structures. The resulting microeconomical aspects are found in the characteristics of any

innovation project: a degree of novelty due to the lack of prior experience, resulting risk and uncertainty, complexity, and a potential of conflict. Apart from the systems design (in the technical sense) the application of robots requires additional project management if realization shall be successful.

The industrial application of robots is a topical manifestation of the economical principle of rationality, which is to achieve optimal results with available resources or to reach well-defined goals with a minimum of resources. As an operational step towards the solution of that problem, the application of robots will contribute to a long-term preservation of substance only if the technical systems design as well as the economical and human-social aspects can be brought to a satisfactory solution.

Thursday, September 30, 1982, 9:00 a. m. to 6:00 p. m., Johannes Kepler University (lecture-halls 1, 2, 7)

Topic of the day: OPPORTUNITIES AND PROSPECTS

LECTURES

9:00 a.m. (lecture-hall 1):

Univ.-Prof. Dipl.-Ing. Dr. Franz Wojda (Technical University of Vienna) Consequences of Industrial Robots in Work Organization

9:45 a.m. (lecture-hall 1):

Dr. Mike Cooley (Open University of London, formerly Lucas Aerospace, England), A Factory without Workers - Nightmare or Desire?

11:00 a.m. (lecture-hall 1):

Prof. Dr. Eberhard Ulich (Swiss Federal Institute of Technology, Zurich) Reality Instead of Utopia: New Opportunities for the Individual and Society

GROUP SESSIONS

1:15 p.m. (lecture-hall 1):

Flexible Automation - an Opportunity for Small and Medium-Size Companies (Dipl.-Ing. Dr. Burkhard Zimmermann, Linz)

1:15 p.m. (lecture-hall 2):

Project Management and Innovation Financing (Univ. Prof. Dipl. Ing. Dr. Josef W. Wohinz)

1:15 p.m. (lecture-hall 7):

Special Questions Regarding the Application of Industrial Robots (Univ. Prof. Dr. Arno Schulz, Linz)

3:45 p.m. (lecture-hall 1):

PANEL DISCUSSION

Industrial Robots - A Challenge for Labour Relations?

Participants:

Fritz Freyschlag (Chamber of Labour for Upper Austria)

Dr. Wolfgang Lauber (Chamber of Labour for Vienna)

Komm. Rat Rudolf Trauner (Chamber of Commerce for Upper Austria)

Dr. Wolfgang Tritremmel (Association of Austrian Industry, Vienna)

Univ. Prof. Dipl.-Ing. Dr. Josef Wohinz (Technical University of Graz)

Univ. Prof. Dipl. Ing. Dr. Franz Wojda

Franz Wojda (born in 1939) studied mechanical and industrial engineering at the Technical University of Vienna. In 1965, Wojda was employed with PHILIPS, then until 1973 was assistant professor at the Institute for Work Sciences of the Technical University of Vienna. He graduated and habilitated there, worked on various research projects and was a consultant for industry and commerce. He travelled extensively in Europe and the USA.

Since 1974, managing director of AGIPLAN Planning Corporation Ltd., Vienna, responsible for planning and consulting of projects with regards to organizational and EDP questions, overall planning of industrial plants (production units, stores, offices), project management of complex projects. Since September 1975, head of the Institute for Work Sciences at the Technical University of Vienna, which was enlarged to the Institute for Work Sciences and Industrial Engineering in 1980. Wojda is also in charge of the interdisciplinary research program of the Funds for the Promotion of Scientific Research in Austria under the title of "Work Organization: Human Centred Working Environment".

Consequences of Industrial Robots In Work Organization

Each technology needs adequate organization, each technical change stipulates complementary organizational improvements for optimizing the respective goals. But there is no clear-cut assignment of certain work organization functions to certain technologies, on the contrary, a large range of different organizational structures is possible, with respectively different, sometimes even contrary effects upon economical, technical, qualitative, or humane objectives. This is valid especially for the application of industrial robots, which as programmable operational tools penetrate areas where manual labour has been prevailing.

We want to show that automation and humanization as well as humanization and economic efficiency are not dichotomous. Automation opens new opportunities for human centred work design, which as such are not necessarily in opposition to macro- or microeconomical criteria. To exploit those opportunities is the great challenge for the engineer of our days, especially for the organizer. This challenge is yet intensified by the speed of industrial robot development.

Dr. Mike Cooley

Dr. Cooley is an unusual combination of active trade unionist, academic and technologist. He was the lay member National President of Britain's largest union for engineers, scientists, and technologists in 1971/72, He is currently Senior Fellow in the Faculty of Technology at the Open University, Visiting Senior Research Fellow at Manchester University in the Business School, and Voluntary Director of the CAITS project at the North East London Polytechnic. He has held seminars and Guest Professorships in Australia, the United States and throughout Europe and his work has been published in over 20 languages. Dr. Cooley has been a senior Design Engineer in the Aerospace Industry for some 20 years, and is an internationally

recognized authority on human centred computer systems. He was Joint Winner of the 1981 alternative Nobel Prize for his work on socially useful technology including human enhancing computer based equipment.

A Factory without Workers - Nightmare or Desire?

The form of technology in a society will inevitably reflect its cultural, economic, ideological, and political assumptions. Thus, the use of human beings within production has been seen as expensive on the one hand, and as a "systems weakness" on the other -in the sense that people represent "unpredictability", "unreliability", and "volatility". A more liberal interpretation is that it is desirable to free human beings from all work.

In consequence, processes have been rendered capital intensive with the elimination of human energy and intelligence. The ultimate 'logical consequence' of this historical tendency is the workerless factory. It will be argued that this 'logic' is defective in a number of major respects. It seriously underestimates human intelligence and the cost and complexity of replacing it. It ignores the significance of work as the means of acquiring tacit knowledge in the Polanyi sense. It views efficiency at the narrow micro level, and tends to ignore the macro consequences and the social multiplier effects. Above all this, it lacks a vision of what truly symbiotic and human centred systems could be like.

Prof. Dr. Eberhard Ulich

Born in 1929. Studied psychology, diploma in 1954, and graduation in 1955, at the University of Munich. From 1955 to 1957, assistant professor at the Max-Planck-Institute for Labour Physiology in Dortmund. Until 1965 assistant professor and lecturer at the University of Munich. Until 1967, lecturer at the Technical University of Munich, until 1969, scientific counsellor and professor for psychology at the German Sports College in Cologne and honorary professor at the University of Heidelberg. Since 1972, professor for Labour and Industrial Psychology at the Swiss Federal Institute of Technology (ETH) in Zurich.

Reality instead of Utopia: New Opportunities for the Individual and Society

It would be either naive or irresponsible not to realize that our world of economy and labour is subject to radical changes. The complexities of national economy, the technological innovations, the uncertainties of resources, the change of values in our culture demand structural considerations from an increasing number of enterprises, considerations that help to take the step from the industrial to the post-industrial society. The question is not whether performance shall be jeopardized, but rather under which conditions the performance necessary for mastering our future can be rendered optimally. The possible extent of changes is outlined by a former estimation stating that the world of the year 2000 will be as different from the world of 1980 as 1980's world differs from that of 1930. Lately, it has been said that the majority of jobs of the 1990's are neither known nor conceivable today. This claim is substantiated by the fact that products are subject to rapid change and that production methods of existing products are expected to improve with further technological development and simultaneous decrease in the cost of new technologies. It will be of vital importance for the future of our society that we understand technological development as an opportunity allowing very different kinds of use.