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Engineering Power

BULLETIN OF THE CROATIAN ACADEMY OF ENGINEERING Vol. 1(1) 1998.

Our Two Organizational Cultures

The communication among scientists and engineers through their professional and learned societies and clubs has a tradition of more than two centuries in Croatia. At the beginning of nineties, nearly a hundred and fifty various, mainly disciplinary societies have influenced regional and national development and progress. Through international co-operation, many of these societies have supported the transfer of knowledge and skills, and promoted internationally the scientific and professional achievements of their members.

The numerous members of these societies have a wealth of knowledge and experience — knowledge that would probably suffice to solve all the various difficulties of the economy of new Croatian state *in status nascendi.* However, this knowledge has been dispersed and has not been organized to carry out such a function. One of our premises was that an individual's knowledge should be harvested and converted into "group knowledge" (or "organisation - available knowledge"). We recognized that a sort of clearing house is needed in which distinguished individuals of various professions could be motivated to investigate the possibilities of multi-disciplinary and inter-disciplinary co-operation, and find appropriate methods of knowledge-management in the service of the economic development of Croatia and the creation of a competitive market position for Croatia.

In the autumn 1991, we founded the very first multi-disciplinary society: The Croatian Systems Society (CROSS), which has successfully united distinguished engineers, economists, sociologists as well as professionals from other disciplines to work on numerous programmes and have contributed to a new spirit of progress. The foundation of CROSS coincided with the recognition of Croatia as an independent state. We believed that the demonstration of the potential of our highly-educated and knowledgeable people through the society's activities would demonstrate the Croatian Government's recognition that our members contribute one of the most important input in the construction of modern and vital state, encompassing the development of a competitive economy.

There is a belief that the times in which we live are of unique historical significance. This is particularly so for people of Croatia, who in the last decade of twentieth century after nearly a millenium of semi-independence, finally became citizens of an independent state. One of our key questions is what our reference in the development of a modern civil state should be, and how we should plan our future, since a previous age, (culture and social arrangements), is coming to an end and another has not yet begun. This is a real challenge!

Encouraged by the positive response to the CROSS and its successful beginning, and knowing of the particular need for the unification of our fragmented engineering community, we decided, in 1993, to establish a learned society for engineers. It was called the Croatian Academy of Engineering, and is compatible with the traditions of the Croatian Academy of Science and Art, which was established in the last century.

During the five years of its existence and work which has been assisted by CROSS, the Croatian Academy of Engineering has grown into a recognized institution, which today successfully combines two organizational cultures — technical and learning. The Academy produces a combined expert and generative power. The engineering power is identified with knowledge, skill, expertise and ingenuity, but also with the desire for quality, change, and improvement. Its positive influence on the wider engineering community facilitates the understanding of economic and social changes, and the cognition of the impact of the rising *Information Society.* The aim of publishing our bulletin *Engineering Power,* is to communicate to the international engineering community, ideas, viewpoints and the results of our work, but it is also to publicize the scientific and professional successes of the Croatian engineering community.

INSIDE

The Beginning of a New Era

The Croatian Academy of Engineering, HATZ, was founded in 1993, when the first members were elected. Every two years the Assembly of Academy decides upon the new members who are nominated by the R&D Institutes, Faculties of Engineering of the Croatian Universities and those who have responded to public invitation.

The election of full and associate Members who are university professors and senior scientists is limited to 120. Affiliated Members are professionals and scientists. Honorary Members are distinguished, national and foreign experts who have achieved notable results in the field of engineering.

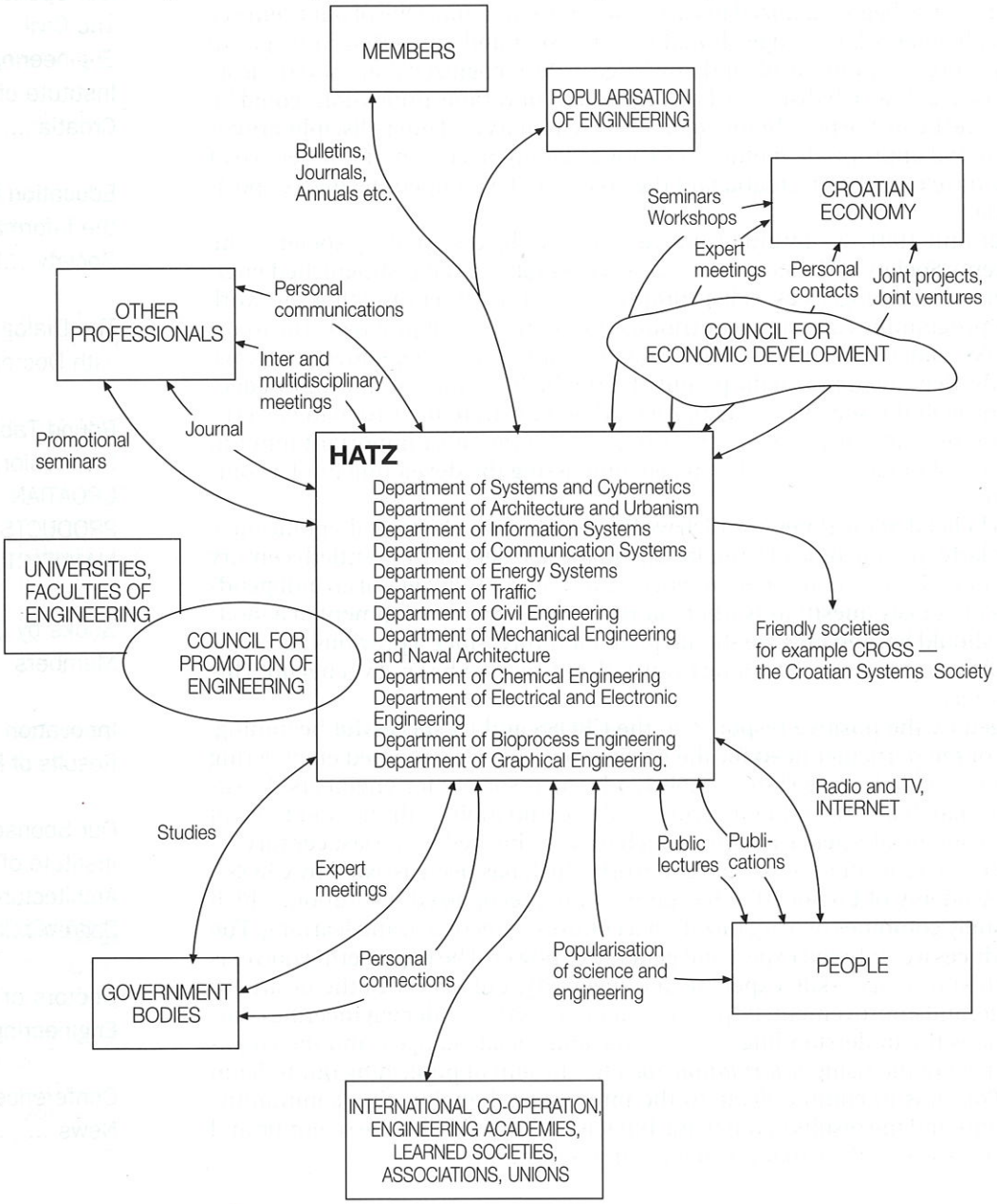
The Academy acts as a whole, organized in twelve Departments lead by the Department Secretaries.

The Presidency of the Academy is composed of the Department Secretaries and Chairpersons of five permanent Boards, and are lead by the President of the Academy and Secretary General, assisted by two Vice-presidents.

From 1998, two important advisory bodies have supported the Presidency in co-operation with the academic community and industry. Their establishment marks the beginning of a new era in the Academy's conduct. Those bodies are:

(a) The Council for the Promotion of Engineering, which is the forum of the Deans of the Faculties of Engineering of the Croatian Universities; and

(b) The Council for Economy and Industry, in which distinguished industrial leaders and experts serve as members together with representatives of the Croatian Chamber of Commerce. The Council is competent for discussions on various questions of industrial policy, and on the role of engineering in industrial and economic development, on the co-operation of the Academy and industry, and research and development organizations.



Our Sponsor

Institut građevinarstva Hrvatske

The Civil Engineering Institute of Croatia

J. Rakuše 1, Zagreb

http://www.igh.hr/ENG/Ref. rtm

The Institute was founded in 1949 under the name of the Civil Engineering Laboratory - Zagreb, with the principle objective of providing extensive infrastructure support to the construction industry, in maintaining and improving the quality of construction activities. Six years later, it gained the status of a research and development institution. In order to meet the growing demand of the construction industry, in the period of 1961-1973, the Institute opened regional units and permanent field laboratories in the major Croatian towns. In 1977, the Institute merged with the Faculty of Civil Engineering, University of Zagreb to form a single entity called the Civil Engineering Institute. But in 1991, the separation of the Institute and the Faculty was required by a new law and the Institute became fully independent. Today, it is one of the leading national research and development institutions, successfully combining fifty years of experience, the availability of modern equipment and a professional approach to every task. The various undertakings of the Institute have been successfully performed equally in Croatia and around the world, in numerous European and African countries, the Midlle East, China, and Malaysia. The Institute performs research and professional activities through seven departments and three regional units:

The Department for Concrete and Masonry Structures
The Geotechnical Department
The Water Management Department
The Department for Steel Structures
The Construction Management Department
The Transportation Department
The Building Design Department
The Regional Unit in Split
The Regional Unit in Osijek
The Regional Unit in Rijeka

It has more than 700 full-time employees, more than half of that number professionals with PhD, master's and bachelor's degrees in civil engineering and other disciplines.

Education for the Information Society

On the Croatian scene, in education nearly everyone is a policy expert. However, times and circumstances have changed. The market has become real, its discipline is exacting, and its ability to reward those who supply its needs is now easily apparent. We asked ourself: what course of action should those who direct the levers of society consider in the adaptation of education to change? How should the tools of regulation, quality assurance and resource allocation be applied to ensure that Croatian education, from preschool to university, fulfills broad public purposes, serves the particular aspirations of individuals, and supports the aspirations of the various institutions?

We acknowledge that there is a definite link between students' engineering and scientific achievements, their future employment opportunities and their quality of life, as well as the nation's economic growth. But in recent years, it is no secret that mathematics, science and engineering have become less popular studies in the Croatian society. We have recognized that policy-makers do not realize that the ability to apply mathematics, science and engineering skills really empowers individuals to make informed decisions as citizens, employers and consumers.

The advent and strenghtening of the Information Society in the European Union has influenced various aspects of our life and motivated the Academy to study the possible impacts on professions in the future, particularly on the future of engineers. A new multidisciplinary programme, *Education for Information Society*, was conceived.

The basic goal:

To contribute to the viability of the Croatian society by the motivation of re-engineering and revitalising the processes of the educational systems and by creating the climate for a continuous increase in the education and intellectual potential of citizens.

To help to prepare citizens for new methods of communication and business, in order to more efficiently act in the changing economic and social environment, through understanding and adaptation to change, occuring in the Information Society.

In November, 1997, the **First Colloquium "Do we cognite the changes?"** was a valuable beginning to our project.

The **Second Colloquium, "Multimedia, distance learning and teaching"**, held in May 1998, was a review of research results in the application of new technologies. Particular attention was given to the use of intelligent tutoring systems in distance learning.

The **Third Colloquium, "Cognition, knowledge and reasoning"**, will be held in October 1998. It was planned to motivate discussion on the present needs and on possible processes of change and the understanding such change, particularly the development of knowledge economy.

The **Fourth Colloquium "Engineer of the Future"** will be held in February 1999 and will be a particularly interesting gathering hosted in co-operation with engineering Faculties from Croatia.

The Dialogue with Doctors

The scientific conference, *Telemedicine in Croatia*, is our very first joint venture with the Croatian Academy of Medical Sciences. It will take place in Zagreb, in November, and has been partly organized as a traditional conference, and partly as a teleconference in which participants from Split and Osijek will be able to join in.

In 1999 two joint forums, under the title, *Communication and Cooperation of Physicians and Engineers*, are planned. The subject of the First Forum will be *Biomedicine and Biotechnology, and Teamwork* will be the subject of the Second Forum.

Our engineers have been supporting physicians in their work more than three decades in various fields of medicine, and in selected fields they have jointly reached worldwide recognition. Unfortunately, culture of teamwork is not developed enough in medicine.

Round Table Discussions

CROATIAN PRODUCTS AND MANUFACTURING

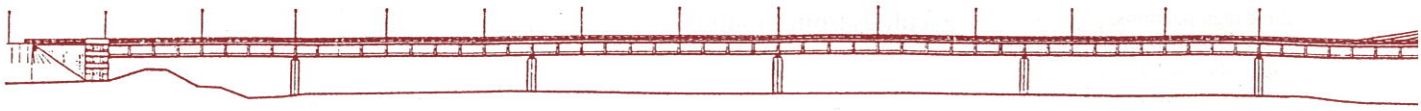
The Idea

Since beginning of the nineties, the Croatian economy has been passing through a very complex period. First, the privatisation of industry has caused big changes and widespread disorientation. This has been made worse by huge war expenses and vast destructions, as well as by migration of inhabitants and an influx of refugees. Further, traditional markets have been lost, and new market's have not yet been established. Much of the industrial sectors were ruined, premises were devasted, productivity has decreased dramatically, and competition in the market-place has weakened. Massive unemployement has followed. In spite of all these circumstances and in addition to a rather hostile political environment, we have survived the most difficult shocks. Now, the Croatian economy is challenged by new situations. On the western border we have the new megastate, the European Union, and on the eastern border, there is a turbulent Balkan. There is the need for the entire organization of a modern state, with an economic infrastructure adapted to those of the European Union, and encompassing the development of the possibility total co-operation. Because of the influence of globalization and the Information Society, the central question for the engineering community, which has substantial potential of knowledge and skill, and which has been a real support to Croatian viability is the following: What will be the source of life for Croatia and what will we produce? This motivated the Academy to initiate the Round Table Discussions under the title: CROATIAN PRODUCTS AND MANUFACTURING, as an examination of the existing working potential and power of action and the likely outcome of the changes in the world economy and strategies. The first series of six Round Table Discussions in 1998 will be followed by the Second series of ten Discussions in 1999.

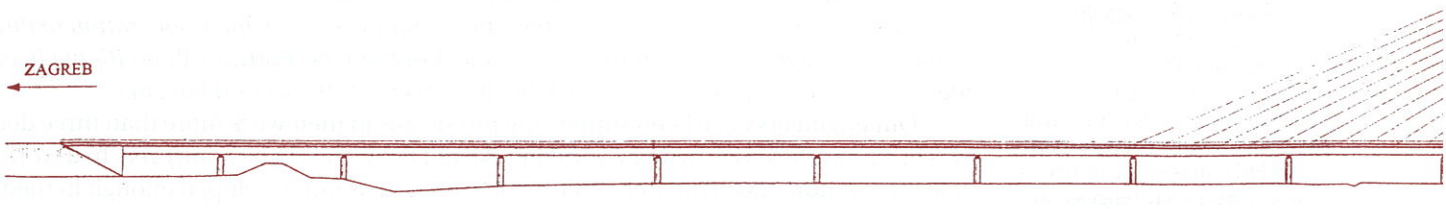
The First Round Table Discussion "What Will Be the Source of Life in Croatia"

considered an exchange of views on the project itself, on the Croatian industrial policy and industry, but also had the aim to motivate the cooperation of engineers and economists to undertake the task of thinking together about the future. Croatia is very dependent on multinational companies and the progress of the Croation economy will be linked very closely to the goals and strategies of these companies. On the other hand the "well-being" of Croatian corporations is equally important, because they influence the development of the small and medium enterprises which could create new jobs and help Croatia to develop a competitive position on the world market. However, meeting this challenge requires the renewal of industry and trade, particularly making better use of knowledge and human skills and cultivating the climate for innovation. The engineering community advocates that the way forward for Croatia must be to compete through knowledge and professional skills, rather than through low wages. So, the transformation of Croatia from an industral economy characterised by a very intensive use of knowledge, should be stimulated by improving human skills, by developing excellent leadership, and by promoting enterprenership and an innovative culture.

Side views of two awarded designs are shown.



The First Award — Authors: Rajka Veverka and Martina Balić from the Croatian Institute for Bridges and Constructions



The Second Award — Authors: Zvonimir Marić, Petar Sesar, Darinko Velem and Vlado Rubetić from the Civil Engineering Institute of Croatia

The Second Round Table Discussion "Manufacturing of Equipment for Energy Processing"

took the form of a debate on the competitive position and possibilities of future development of the manufacture of **equipment for energy processing and electrical power generation**. Nearly one hundred experts paricipated in the discussion and contributed to a better understanding of this well-recognized sector of the international market. However, the goals and strategy of development of this industry does not only depend on the will and knowledge of engineers, but even more especially on political decisions. It was shown that Croatian engineers have the potential and the competitive power, by the proper conduct of the top management, and that they are ready to offer engineering services for the building of hydro-electric power plants and other large-scale projects on the international market.

The Third Round Table Discussion on Shipbuilding

considered the future development of **shipyards and shipbuilding**. Their revitalisation as competitive and highly productive business ventures attracted particular attention. The recent merger of four leading enterprises into one organization, initiated a very interesting debate. The questions of manpower, innovations, new technologies and relations with SMEs were emphasised as important subjects which require much attention.

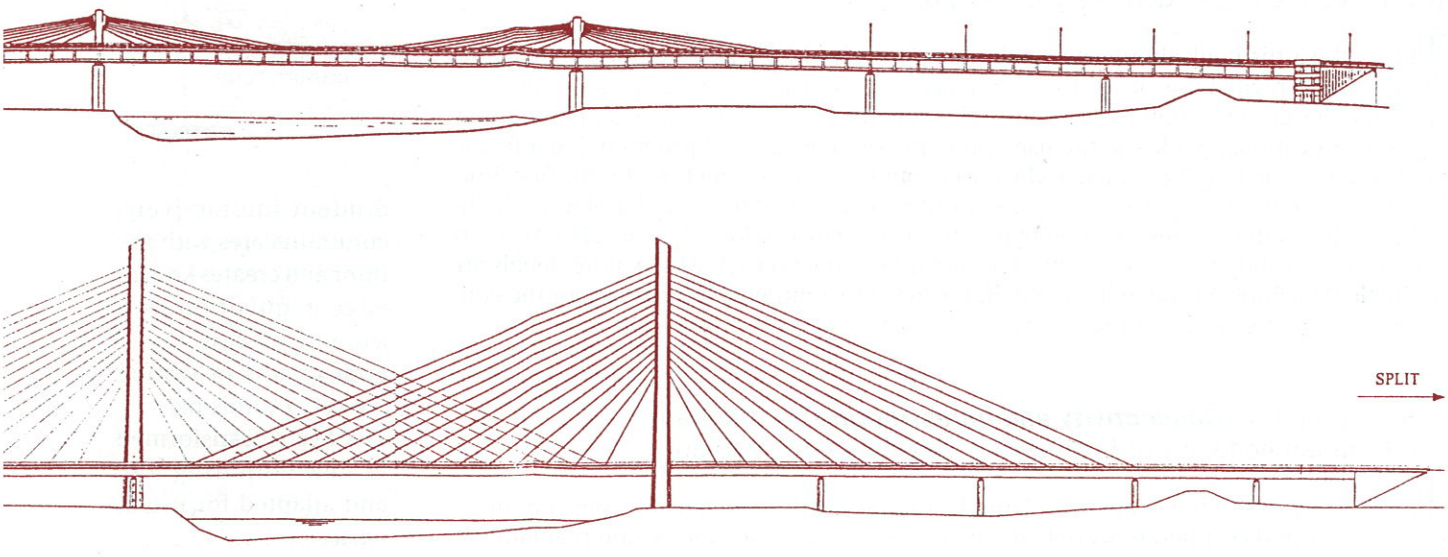
The Fourth Round Table Discussion on Food-processing

gathered well-recognized experts in food-processing who exchanged experiences and views on the food-processing industry, the current position of the industry and challenges in the market place, on globalisation and on new technologies available in the industry. Debate on research and development was particularly lively. Successful food-processors presented some of their positive experiences. Co-operation with agriculture sector.

The Fifth Round Table Discussion on Building of Bridges

will be a particularly interesting gathering of designers, construction engineers and builders, who specialize in bridges building. It is a field with a long tradition in Zagreb and therefore many highly-qualified experts compete in response to tenders in Croatia. At this time, the competition for the bridge to be built over the River Sava is encouraging fresh ideas, while the construction of the new bridge near Dubrovnik has just begun. However, the central question is the approach to the international market, which prefer stainless steel constructions, while in Croatian practice reinforced concrete dominates.

The recent contest for new multi-functional bridge over the River Sava in Zagreb will attract discussion on the contemporary approach to the design.



Books by Our Members

Zijad Haznadar and Željko Štih, ***Electromagnetizm*** (in Croatian),
Part 1, 420pp; Part 2, 356pp; Školska knjiga, Zagreb 1997.
ISBN 953-0-31686-0

This book gives the reader a complete overview of the classical electromagnetic theory, static, quasi-static fields and electromagnetic waves, together with a presentation of modern numerical procedures for the analysis of electromagnetic problems.

Part 1 - Electromagnetic Theory, Static and Quasistatic

Fundamental electromagnetic field quantities and different forms of equations and models for solving electromagnetic field problems are described in the first chapter. Potential theory is presented in second chapter. The third chapter gives an insight into energy relations and the calculation of forces in electromagnetic fields. Static electric, current and magnetic fields are analyzed in detail in the following three chapters. Different methods of solving static field problems are illustrated by elaborate examples. The seventh chapter describes quasi-static fields which satisfy low-frequency approximation. These fields are usually found in devices for energy conversion and transmission.

Part 2 - Electromagnetic Waves

A detailed description of electromagnetic waves is given in the eighth chapter. It begins with derivation of the plane wave equations and description of the propagation of electromagnetic waves in different materials. These topics are followed by an analysis of the skin effect in conductors, losses in insulators and conductors and dispersion. Following that, propagation of the plane waves in half-bounded spaces, reflection and refraction are explained in detail. Propagation of guided waves through transmission lines waveguides and resonators is also described. The nature and properties of the radiation of electromagnetic waves are explained at the end of this chapter. A detailed insight into the finite element method is given in the ninth chapter. Application of this method is illustrated by a solution of two-dimensional static and quasi-static field examples. The method of moments is explained in the tenth chapter. The application of this method is illustrated by computation of three-dimensional static electric fields, analysis of scattering of electromagnetic waves and solution of Pocklington's equation. The books are intended for electrical and electronic engineers, physicists and applied mathematicians, and are also suitable for undergraduate and postgraduate students of these disciplines.

Boris Androić, Darko Dujmović, Ivica Džeba, ***Beispiele nach EC 3 - Bemessung und Konstruktion von Stahlbauten*** (in German),
Warner-Verlag Dusseldorf, 1996, 601 pp.

This is the is the book about a new didactic approach which was developed for teaching the European regulations of steel structure design. The reader can learn about new steel structure design philosophies easily, quickly and effectively. The book is based on many years of educational work and the use of the modern educational program, ESDEP. The book is not meant only for students who are encountering steel structures for the first time, but is also suitable for experts with extensive experience, so that they may familiarize themselves with new discoveries and therebyprogress in their profession. The publisher, Werner--Verlag, has included the book on its literature list on the Internet, where more details are available. The book has been included on the list of recommended literature for the education of students in German-speaking countries.

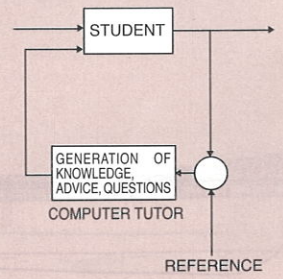
J. Božičević, Ed., ***Connectivity and Infrastructure*** (in Croatian),
The Croatian Academy of Engineering, Zagreb 1998, 308 pp.

The Proceedings of the Academy's Third Conference with selected 55 papers on the connectivity and co-operability of Croatian infrastructure institutions and regulations to the current praxis in the European Union.

Innovation Results of R&D

Slavomir Stankov from the University of Split and Juraj Božičević from the University of Zagreb have developed an original intelligent tutoring system, TEx-Sys, presently being tested in work with students.

TEx-Sys, the Tutor Expert System, was developed to serve students in learning control principles in nature, society and technics on the basis of the isomorphic model of system. In the instruction system the computer tutor, a substitute for the human tutor, acts as control unit supported by domain knowledge base. It compares the actual student's knowledge with a given reference and performs several actions: delivering knowledge, generating test questions and advising the student.



Student interactively, communicates with the tutor and creates knowledge acquisition or a learning process.
First results of testing are very promising.
TEx-Sys is transformed in new authoring tool and adapted for use at *www.*

Our Sponsors

Brodarski institut

Institute of Naval Architecture, Avenija V. Holjevca 20, Zagreb

Since its foundation in 1948, the scientists and professionals of the Institute, have made a crucial contribution to Croatian shipbuilding, and the Croatian economy, through numerous research and development projects related not only to shipbuilding, but also to other branches of industry, such as electric power supply, computer technology, chemistry, mechanical engineering and even medicine. The Institute, like the majority of related institutions in the world, is introducing modern methods that will soon become essential tools in daily, routine work. Ship hydrodynamics, traditionally relying on experiments, is presently undergoing radical changes. New methods are being introduced for ship hull form design, for designing propulsion systems and rudders, for predicting ship behaviour in waves and manoeuvrability characteristics, for determining cavitating flows, as well as for solving other important hydrodynamic problems. However, the usefulness of the well - equipped hydrodynamic laboratories, for example, the large towing tank, 300 meters long, and the large cavitation tunnel with two working sections, is still indisputable and particulary important for the final testing of the characteristics of new vessels. The specialists at the Institute have wide experience in developing, designing, building, supervision and exploitation of various special vessels such as submarines, frigates, missile corvettes, submersibles, training vessels, minehunters, transport vessels, attack craft and many others. In the Institute's modern and well--equipped designing offices, the missile corvette, the midget submarine, and other Croatian Navy vessels have been conceived and designed.

Doctors of Science in Engineering

Dragan Kovačević

Determination of Thermophysical Properties of Frozen Food

The book presents the results of work on the determination of thermal conductivity k, the temperature of initial freezing point T_f, apparent enthalpy H and thermal diffusivity a under laboratory conditions: an apparatus with a linear heat source for determining k by the impulse method, a DTA apparatus for determining T_f and H through a qualitative analysis of DTA curves, and an apparatus for determining a through the application of Dickerson's method. An *on-line* connection between measurement apparatuses and a computer made possible the direct monitoring of the thawing process of the sample with high temperature sensitivity (10 mK), frequency sampling rate (3,5 kHz) and statistical filtration of measured temperature and time values (tolerance ± 3s), and simple processing and graphic interpretation of the results. The geometry of the measurements apparatuses and the applied sample heating velocity ensured the domination of one-dimensional thermal transfer, the minimization of boundary influence and measurement sensitivity to the sample temperature distribution and the quasi-steadiness of the thawing process, which ensured the isothermal properties of the sample. The possibility of determining k, T_f, H and a through the application of the above methods and constructed mathematical models, the congruency between the experimental results and the literature on the subject and the reproducibility of the results that was achieved, all point to the success of the constructed apparatus solutions, (particularly the measurement system), and the selection of parameters that define the measurement conditions and methods.

Thermophysical properties were determined in surimi samples prepared in laboratory conditions from *Sardina pilchardus*, with the addition of NaCl (w = 1-10%), carrageenan (w = 1-10%), and a mixture of NaCl and carrageenan with a mass ratio 1:4 (w = 1-10%), as well as in the samples of chicken egg, (egg-white, yolk), mixed with NaCl (w = 1-10%).

Mentor: dr.sc. Želimir Kurtanjek, Associate Professor, Faculty of Food Technology and Biotechnology, University of Zagreb.

The thesis was defended on November 29, 1997.

Marijan Golja

Analysis of Steel Flow Stress by Elevated Temperatures and Deformation Flow of Materials in the Processes of Periodical Rolling o Seamless Steel Tubes

Stress in the state of flow and plasticity of steel at elevated temperatures is investigated. The results obtained by the hot torsion test and by the tensile test on carbon and low-alloyed structural steels for special application at the temperatures form 1073 K to 1473 K (888°C - 1200°C) are analysed and serve as a basis for the determination of parameters of steel deromation during the rolling of the hollow shell on the Pilger mill, also, the survey of the technological procedures in the production of seamless steel tubes. The mathematical model cooling and the temperature distribution inside the steel rough pierced tube after the rolling was developed and studied by the finite difference method. The real deformation flow was examined during the periodical rolling of steel tubes and useful recommendations for the process improvement were made.

Mentor: dr. sc. Ilija Mamuzić, professor, Faculty of Metalurgy, University of Zagreb.

Conference News

The Fourth International Multi-disciplinary Conference
ENGINEERING FOR THE CROATIAN ECONOMY
SYSTEMS APPROACH TO SUSTAINABLE DEVELOPMENT

September 26-29, 1999
Dubrovnik, Croatia

The Croatian Academy of Engineering (HATZ) and The Croatian Systems Society, (CROSS), will hold their Fourth Conference dedicated to a range of topics relevant to the sustainable development.

Topics of interest include, but are not limited to:

- The concepts of sustainable development, models, scenarios and perspectives;
- current trends in social processes in countries in transition, their implications on economic processes and possible consequences on the ecosystem;
- the role of engineering in the efficient use of resources, in the development of appropriate, environment-friendly technologies, in the maintenance of clean and safe production, and in the reduction of emissions;
- eco-efficiency as a competitive alternative in international trade; experiences and perspectives of enterprises in countries in transition;
- the influence of globalisation and international institutions (e.g. GATT, MAI), in the economies of countries in transition and the ability of authorities to understand and control such influences.

This Conference will bring together those who care about our planet, and those dealing with various aspects of the sustainable social, economic, engineering development.

We are particularly interested in focusing on the experiences from the countries where the economies are in transition, and also the industrial practices of such countries. Therefore, we will especially promote the participation of professionals from industry and offer opportunities for academicians and industrial colleagues alike to interact, learn and share current experiences.

SUBMISSION OF PAPERS

Prospective authors are invited to submit original and previously unpublished papers according to the listed topics. Abstracts in advance clearly explaining the contribution, it's originality and the relevance of the work are expected.

Submitted abstracts should be restricted to a maximum length of one page and have to be submitted in paper form. The speaker should be clearly identified.

The abstracts will be reviewed by the Programme Committee. The authors of accepted papers will be asked to submit a full paper of 10 pages to be included in the printing of the Conference Proceedings. Detailed information for authors will be provided with acceptance.

Deadline for receipt of abstracts:
February 24, 1999

Notification of acceptance:
April 4, 1999

Deadline for ready-for-press papers:
June 6, 1999

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