John von Neumann Faculty of Informatics

Institute of Intelligent Engineering Systems

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1   Introduction

The Institute of Intelligent Engineering Systems was founded two years ago within the John von Neumann Faculty of Informatics, part of the Budapest Tech Polytechnical Institution. The staff of the institute is fairly small, but efficient. It includes nationally and internationally recognized experts and researchers, providing high-quality BSc education and the scientific background to a future successful PhD course. The Institute of Intelligent Engineering Systems is at the same a time research-centred organization with the objective to intergrate interdisciplinary informatics for engineering purposes, computer modelling, intelligent computing, and applied computer science. The Institute participated in various projects including the Nationwide Scientific Research Base Programs, Bilateral Governmental TéT Co-operation Fund, and these are all documented with publications.

There are two scientific workshops within the institute, based partly on the year-long scientific research activities of the members of the institute, partly on novel research results leading to new plans. The institute is constantly expanding their scope of co-operation to staff members of other faculties of the Budapest Tech, other partner institutions from Hungary as well as from abroad. International co-operations are actively supported through bilateral and international conferences, where the associates regularly publish their papers. Members of the institute's staff also act as editors, reviewers to a number of highly acclaimed journals, and take up high posts at various scientific institutions both within the country and abroad.

The director and founder of the institute is Dr. Imre J.Rudas, DSc, doctor of the Hungarian Academy of Sciences, full professor and also rector of the Budapest Tech. Among the staff are also Dr. János Fodor, DSc, doctor of the Hungarian Academy of Sciences, full professor and Vice-rector for Sciences of the Budapest

Tech; Dr. János F. Bitó, doctor of technical sciences, recently honoured with the Professor Emeritus title, who continues to actively participate in the institute's work; Dr. László Horváth, CSc, candidate of technical sciences, college professor, vice-dean for research of the John von Neumann Faculty of Informatics; Dr. Aurél Galántai, DSc, doctor of the Hungarian Academy of Sciences, full professor; Dr. József K. Tar, PhD candidate of technical sciences, professor; Dr. Gyula Hermann, CSc, candidate of technical sciences, professor; Dr. Márta Takács, PhD, associate professor, vice-director at the Institute, and Éva Jánki-Mayer, responsible for administrative tasks at the Institute.

While the institute continues to be an internationally well-known research faculty, it slowly emerges as a place with R&D profile directly connected with the industry. The areas are gradually being defined in which industrially useful research and development activity is carried out. There remains much to be done in this acpect until significant results emerge, but this profile adds to the positive image of the future of the Budapest Tech, and its close co-operation with the recently-established Knowledge Center.

2 Educational Profile

All of the staff at the institute have a long-standing past and experience in teaching. They have worked for many years as university or college educators, and participate niw actively in the teaching activities of the BSc courses of the college. Among these tasks are providing up-date teaching materials and publishing textbooks. While the courses taught are closely connected with their individual areas of interest, the members of the institute teach a number of basic introductory course, as well. In the field of mathematics it is worth mentioning the areas of analysis, linear algebra, numerical methods, and the teaching of applied mathematics in general. Basic courses in informatics at the Bánki Donát Faculty of Mechanical Engineering are still partly held by the members of this institute. Other courses taught include operation systems, databases, programming languages and algorithms.

An important area of activity at the institute is the computer modelling and designing of systems, and teaching courses connected with mechatronics to future engineers. In this spirit the John von Neumann Faculty of Informatics initiated specialized courses under the term 'Virtual Informatics Technology'.

In recent years the associates of the institutes have significantly contributed to the creation of the curriculum for planned masters courses for informatics engineers within the John von Neumann Faculty of Informatics. They have assembled the curricula for the individual courses, and compile the background material for the accreditation. The curricula for the masters courses are continually being worked

on. Certain requirements regarding Hungarian Accreditation Committee (MAB) evaluation, and the scientific environment have to be met within the faculty, and this is likely to alter the relationship of teaching and research, the two basic activities of the institute. Four scientific workshops have been established as part of the background to the masters courses in order to provide the neccessary interdisciplinary profile. Two of these workshops operate within the Institute of Intelligent Engineering Systems.

The staff of the institute constantly offer topics for thesis works connected to the field of operation of these workshops, and provide thorough assistance to the students working on theses. Our colleagues also act as reviewers not only within the Budapest Tech, but other higher education facilities throughout the country. They have reviewed numerous doctoral dissertations, among others at the Science University of Novi Sad, Serbia, Gent University, and Technical University of Košice, Slovakia.

3   Research and Scientific Activity

Scientific Workshops

The head of the **Workshop on Intelligent Systems** is János Fodor. The area of interest of this workshop is fuzzy arithmetic and analysis, preference-modelling, machine intelligence, soft computing and intelligent control.

The staff this institute have already had significant research results in this area in earlier years. Through his outstanding international scientific work János Fodor, head of the workshop, has played an important role in introducing fuzzy in Hungary, and in defining the place of fuzzy among the mathematical disciplines. Besides these he is also acively involved in the area of operation research. In his research he is supported by the mathematicians of the institute, Aurél Galántai and Márta Takács, as well as the engineer-mathematicians. They have mainly reached siginificant results on the basic research of fuzzy operators, developing fuzzy inference systems, and based on this, creating expert systems, developing machine intelligence. Fuzzy, genetic algorithms and neural networks as well as soft computing technologies all strengthen each other in application, thus advancement is expected in all three areas. General operation research, research of numerical methods and the developments in connection with algorithms are all applied in the solving of various controll and modelling tasks and are published among with detailed simulation results. The expected primary field of application will probably be intelligent control, but it is likely to continue to play an important role in interdisciplinary areas such as image recognition, geology and in preference modelling in general.

One of the most important areas of research of the past years in the workshop is the impact analysis of various modell through simulation. Out of the operators which may be applied in the inference system of fuzzy logic-based control models, it is the uninorms and distance based operators [1] of which it can be stated that under identical environmental conditions, by altering a single parameter we can achieve a 30% change within the functioning of the system. These researches further the creation of adative and hierachical complex fuzzy controlled systems [2]. The latest research involved the control of a satellite antenna, where even while it is working, a change of parameters can easily be carried out and a significant change of outcome achieved. (Figure 1)

Another field of application of the base reseach work done in the workshop of image resolution, compression, where the use of new operator families as opposed to traditional methods has also brought a visible increase in quality [3].

Following Aurél Galántai's joining the institute and the workshop significant advancements are to be expected concerning the application of operation research, applied mathematics and mathematical algorithms in the field of intelligent systems.
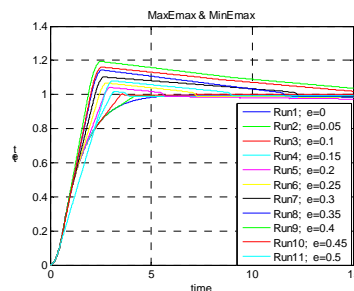

Figure 1

Outputs measured during control of the satllite antenna depending on the change of parameters [2]

[1]   Imre J. Rudas: *Absorbing-Norms,* WSEAS Transactions on Systems, Issue 5, Vol. 3, July 2004, pp. 1933-1938

[2]   Márta Takács, Ágnes Szeghegyi, Claudiu Pozna: *Quick Comparison of the Efficiency of Fuzzy Operatios Used in FLC*, in Proceedings of 4th Serbian-Hungarian Joint Symposium on Intelligent Systems, SISY 2006, Subotica, Serbia, September 29-30, 2006, pp. 73-80, ISBN 963 7154 50 7

[3]   János Fodor, Imre J. Rudas, Barnabás Bede: *Uninorms and Absorbing Norms with Application to Image Processing*, in Proceedings of 4th Serbian-Hungarian Joint Symposium on Intelligent Systems, SISY 2006, Subotica, Serbia, September 29-30, 2006, pp. 59-72, ISBN 963 7154 50 7

The head of the scientific **Workshop on Intelligent Mechatronic Systems** is Imre J. Rudas. The areas of research of the workshop are information aggregation, imprecisely modelled mechnical systems, intelligent modelling of engineering objects, intelligent HCI, robot modelling and control.

Information aggregation models apply the results of operation research as well as traditional models. Soft computing technologies are applicable in the control of inprecisely modelled mechanical and mechatronical systems. The workshop's main focus is on modelling engineering objects, manufacture and other processes. These are complex systems, thus their simulation and analysis of efficiency using various methods preceding industrial application is crucial. All members of staff participate in the workshop's work, but special mention has to be made of the work of Imre J. Rudas, who provided noteworthy and long-lasting results in both national and international research in robotics; László Horváth, József K. Tar, and Gyula Hermann, who have all presented important results in the areas of science of modelling, robot modelling and controll, measurings and applied software technologies, respectively. The multidisciplinary area of interest and long-standing industrial experience of János F. Bitó are vital to the workshop, but indeed to the entire institute.

The two-volume work also illustrates the success of the workshop, it is collection of publications on intelligent systems which was edited by Imre J. Rudas along with famous colleagues from Germany and Portugal ([4], [5]). This edition contains the results of the joint research of Imre J. Rudas, László Horváth and József K. Tar.

[4]   Wilfried Elmenreich, J. A. Tenreiro Machado, Imre J. Rudas (Eds): *Intelligent Systems at the Service of Mankind, Vol. 1,* Ubooks, Germany, 2003

[5]   Wilfried Elmenreich, J. A. Tenreiro Machado, Imre J. Rudas (Eds), *Intelligent Systems at the Service of Mankind, Vol. 2*, Ubooks, Germany, 2005
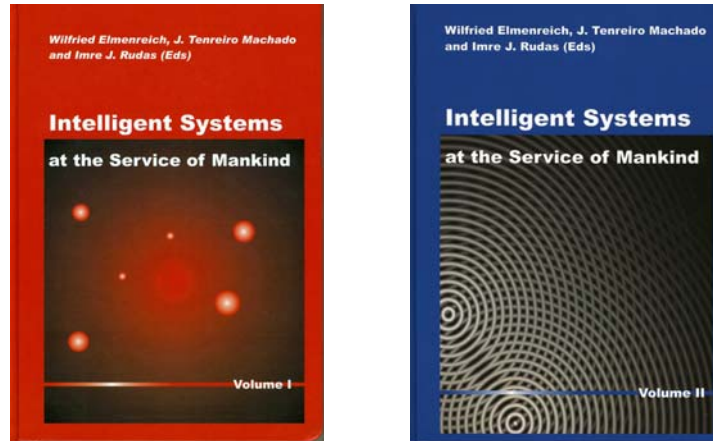
The work of both workshops is supported by the **Laboratory of Intelligent Engineering Systems**, operating within the institute (Fig. 2). It is expected that there will be various analyses in the fields of engineering informatical methods and systems, as well as product modells. Experim ents are conducted in the areas of presentation of designer intention, communication between higly integrated intelligent, environment adaptive modell-objects and their production environments, modellbased processes supporting multi-figure engineering
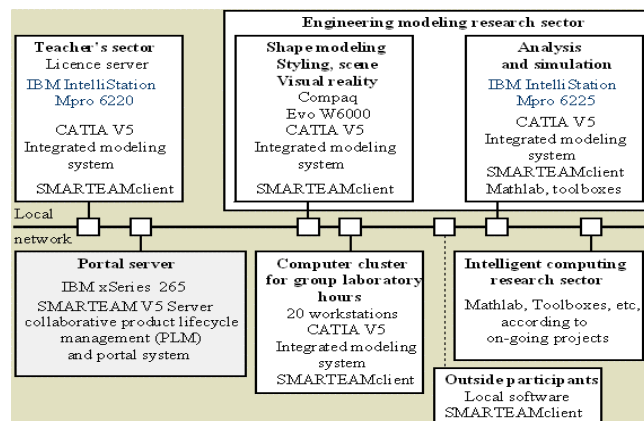

Figure 2

Th estructure of the Laboratory of Intelligent Engineering Systems

decisions, chosen virtual engineering processes, numerical methods applied for simulation, and exterior communication of product lifecycle management systems. The experimental environment necessary for research is comprised by suitably configured induestrial engineering informatics systems within the Laboratory of Intelligent Engineering Systems. The sudden explosion in both the horizontal and

vertical development of engineering informatics systems has made it necessary to come into close professional cooperation with a market leading developer. This would enable the institute to dispose of valuable knowledge on informatics technologies, vital for further research and teaching activities, and more importantly, dispose of such software systems. The main focus is on managing product data, engineering co-operation, and integrated support of engineering decisions during entire lifecycle of products. The Product Lifecycle Management Competency Center (PLMCC) is about to be established as part of the contract for co-operation with the French Dassault Systemes, leading company in this area.

Projects

There are several projects running, or have been running until recently, which are well documented with publications and supported by contracts.

The head of the project called **'Connection of the Fieldbus System with the Internet for Realization of Remote Control of Intelligent Environment-Adaptive Product Modells'** was László Horváth. It was supported by the Bilateral Governmental TéT Co-operation Fund, it ran between 2003 and 2005. In this project the partner from abroad was the University of Pretoria, South Africa. The aim was to define conditions necessary for communication through the Fieldbus, and product equipment control based on product modelling conducted in the early stages of the project. Further research areas included the determination of behaviour characteristics for control of adaptive engineering processes, as well as previous determination of predictable behaviour of modelled objects. Associativities were examined which are needed for the connection of engineering and automated industrial environments. Three outstanding publications were born as a result of this project:

[6]   László Horváth, Imre J. Rudas, János F. Bitó, Gerhard Hancke: *Intelligent Computing for the Management of Changes in Industrial Engineering Modeling Processes*, in Proceedings. of IEEE 3rd International Conference on Computational Cybernetics, ICCC 2005, Mauritius, April 13-16, 2005, pp. 249-254, ISBN 0-7803-9122-5

[7]   László Horváth, Imre J. Rudas, Gerhard Hancke: *An Integrated Process Based Approach to Industrial Robot Application Related Engineering*, in Proceedings of 14th International Workshop on Robotics in Alpe-Adria-Danube Region, RAAD'05, Bucharest, Romania, pp. 380-385, ISBN 973-718-241-3, 2005

[8]   László Horváth, Imre J. Rudas, Gerhard Hancke: *Challenges of an Aspect Driven Way in Product Model Supported Robotics*, in Proceedings of the 5th International Symposium of Hungarian Researchers on Computational Intelligence, Budapest, Hungary, November 18-19, 2005, pp. 201-214, ISBN 963-7154-43-3

The Theoretical Basis and Development of Intelligent, Environment-Adaptive Objects of Highly Integrated Product Models was a project running from 2002 to 2005, lead by László Horváth, and supported by the Nationwide Scientific Research Base Programs (OTKA). The scientific results of this project refer to the analysis of adaptive characteristics of modell objects, modelled product objects and their area of influence. During the project complex definition was given to intelligent, widely and highly associative modell objects which are capable of adaptive communication within highly integrated, large scale structures comprised by computer modells of products.

Eight papers were published as a result of this project, the three most important ones being:

[9] László Horváth, Imre J. Rudas: *Virtual Intelligent Space for Engineers*, in Proc. of the 31st Annual Conference of the IEEE Industrial Electronics Society, IECON 2005, Raleigh, North Carolina, USA, 2005, pp. 400-405

[10] László Horváth, Imre J. Rudas: *Intelligent Shape Centered Models*, in Proc. of IEEE International Conference on Systems, Man & Cybernetics, SMC 2005, The Big Island, Hawaii, USA, 2005, pp. 3012-3017, ISBN 0-7803-9299-X, IEEE Catalog Number: 05CH37706C

[11] László Horváth, Imre J. Rudas, *Associativity: Adaptivity and Behavior Aspects in Modeling for Manufacturing Related Robot Systems*, in Proc. of IEEE International Conference on Robotics & Automation, ICRA 2005, Barcelona, Spain, 2005, pp. 3017-3022, ISBN: 0-7803-8915-8, IEEE Catalog Number: 05CH37639D
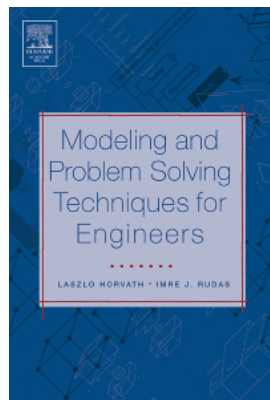
During the active period of the project a publication was born giving a detailed presentation of this topic:

[12] László Horváth, Imre J. Rudas: Modeling and Problem Solving Methods for Engineers, Elsevier, Academic Press (2004)

The New Family of Adaptive Control of Attached, Non-Linear, Multi-Variable Systems is the title of the project lead by Imre J. Rudas during 2005-2006, and supported by the Bilateral Governmental TéT Co-operation Fund. The international partner is University of Tohoku in Sendai, Japan. So far the functioning of its own control expanded to traditional ARMAX and negative definite systems have been compared with each other on the example of a

mechanical system which partly-driven, not modelled inner degree of freedom. Simulation examples have shown that both systems work, and lead to comparable results. Perturbation calculation proved the stability of stationary solutions. Then rough first-rate ARMAX controller was constructed using averages calculated near the quasi-stationary limit. It was determined that a finer resolution that 0.1 s pattern tracking was needed for the more precise control of this system. Following this the relaxation of stationary conditions were examined with exact modell calculations for the signal's step-like significant jump. In this topic two publications were created based on the project, and further papers await publication.

The project under the name of **Integration of Non-Linear Systems as Green-function in Control Based on New Soft Calculating Procedures** was headed by József K. Tar and supported by the Bilateral Governmental TéT Co-operation Fund in 2005 and 2006. The partner abroad was the Institute of Engineering of Porto, Portugal. The results can be summed up as follows: the simulation analysis of the adaptive control of the car + double pendulum system, while the precise model of the system was not the disposal of the controller. The adaptive approach was based on the use of special simplectic matrices, and concerning the required kinematical behaviour regulation, a PID controller that was altered to be fractional level, in which the fractional level was calculated using discrete time-resolution numerical approximation with Caputo-form definite memory. Beside limited time-resolution, limited memory approximation further examinations included the connection between fractional and whole number derivates. Beyond the mechanical phenomena the analysis also comprised the typical fractional dynamics occurring in the field of electromagnetic phenomena. Altogether six publication were written with the support of this project. Of these the three most noteworthy are the following:

[13] József K. Tar, János F. Bitó, Imre J. Rudas, J. A. Tenreiro Machado: *Adaptive Reduction of the Order of Derivation in the Control of a Hydraulic Differential Cylinder*, in Proceedings of 14th International Workshop on Robotics in Alpe-Adria-Danube Region, RAAD'05, Bucharest, Romania, 2005, pp. 513-518, ISBN: 973-718-241-3

[14] József K. Tar, Imre J. Rudas, János F. Bitó, J. A. Tenreiro Machado: *Centralized and Decentralized Applications of a Novel Adaptive Control*, in Proceedings of IEEE 9th International Conference on Intelligent Engineering Systems, INES 2005, Mediterranean Sea, pp. 87-92, ISBN: 0-7803-9474-7, IEEE Catalog Number: 05EX1202C

[15] József K. Tar, Imre J. Rudas, János F. Bitó, J. A. Tenreiro Machado: *Improved Numerical Simulation for a Novel Adaptive Control Using Fractional Order Derivatives*, in book Intelligent Systems at the Service of Mankind, Vol. II, Ubooks, Germany, 2005, pp. 283-294, ISBN 3-86608-052-2

The Technical University of Timisoara is the partner in the Romanian-Hungarian TéT project (under the identification number 35ID17) with the topic Intelligent Systems. The project is active in the period of 2006-2007, the heads from this institute are József Tar and László Horváth. The first joint results were presented at the SACI 2006 conference in Timisoara in the spring of 2006 (http://www.bmf.hu/conferences/saci2006).

[16] Zsuzsa Preitl, Radu-Emil Precup, József K. Tar, Márta Takács: *Experiments in Multi-parametric Quadratic Programming*, in Proceedings of 3rd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence, SACI 2006, Timisoara, Romania, May 25-26, 2006, pp. 98-110, ISBN 963 7154 46 9

Further the members of the institute's staff have currently Tét projects and an OTKA project awaiting acceptance, which are to support the work of these two workshops once they have been acceptance.

Publication Activity

The publication activity of the staff members of this institute huge. To sum up, the entire list of publications includes 9 English-language books published abroad, 6 books in Hungarian describing research details, more than 40 textbooks, university and college notes, 52 chapters published in various books abroad, more than 150 articles in reviewed foreign-language publications, journals, 80 articles published in reviewed Hungarian journals, more than 650 articles in foreign languages published in the proceedings of international conferences. While the participation and publishing in Hungarian conferences is also significant, it has to be mentioned that beside the numerous articles published in the international proceedings, there have been at least 20 plenary lectures held by members of the staff at the these conferences only in the last few years. The number of references to these publications and articles is estimated to be more than one thousand.

Owing to the renowned research and publication activities the staff of the institute act as members of the editorial staff of a large number of national and international scientific journals, including the Fuzzy Sets and Systems, the European Journal of Operational Research, the Computing and Informatics, the Control Engineering Practice, the Engineering Applications of Artificial Intelligence, the IEEE Transactions on Industrial Electronics among others. They are also regular reviewers of articles submitted to other journals, as well.

The members of this institute have been among the first to publish partly independently, partly along with their foreign colleagues and partners in the series of journals published at the Budapest Tech, the Acta Polytechnica Hungarica, so far there have been 10 articles in 8 issues.

http://www.bmf.hu/journal

The 3rd issue of the 3rd series was edited by Imre J. Rudas and István Preitl from Timisoara based on the above-mentioned Romanian-Hungarian TéT project, this edition collected publications from the area of soft computing, including papers by members of the institute's staff [17], [18].

[17] Acta Polytechnica Hungarica, Vol. 3, Issue Number 3, *Special Issue on Applied Computational Intelligence*, Guest Editors: Stefan Preitl and Imre J. Rudas

[18] S. Preitl, R. E. Precup, J. Fodor, B. Bede: *Iterative Feedback Tuning in Fuzzy Control Systems. Theory and Applications*, in [17]

This year a special edition of the Japanese journal 'Journal of Advanced Computational Intelligence and Intelligent Informatics' (JACIII) was prepared, edited by Imre J. Rudas and János Fodor, which gave a selection of the papers on intelligent systems published at the INES 2005 and SISY 2005 conferences [19]. Papers of five members of staff were included, all co-operations with Japanese and Serbian researchers [20], [21], [22].

[19] Journal of Advanced Computational Intelligence and Intelligent Informatics, Special Issue Dedicated to INES 2005 and SISY 2005 Conferences, Edited by Imre J. Rudas and János Fodor., Vol. 10, No. 4, 2006

[20] Barnabás Bede, Hajime Nobuhara, János Fodor, Kaoru Hirota: *Max-Product Shepard Approximation Operators*, in [19]

[21] Endre Pap, Márta Takács: *Two-Dimensional Copulas as Important Binary Aggregation Operators*, in [19]

[22] József K. Tar, Imre J. Rudas, Miklós Rontó: *Geometric Identification and Conrol of Nonlinear Dynamic Systems Based on Floating Basis Vector Representatin,* in [19]

From the sum-up of the list of publications for the past two years it protrudes that the concentrated organizational unit of the Institute of Intelligent Engineering Systems stimulates the writing of joint publications.

Scientific-Public Activities

The staff of the institute take up important positions in scientific and educational committees of organizations such as MAB, MTA, MRK, FFK, OTKA.

Imre Rudas is among others regularly invited to the plenum of the MAB, the president of the FFK, member of the Computer Science and Automation Committee of the Hungarian Academy of Sciences, member of the Informatics Committee of the Hungarian Academy of Sciences, member of the OTKA Committee, co-president of the Hungarian Rectors' Conference, vice president of the IEEE HS (the Hungarian Association of Electrical Engineers), president of the Hungarian Fuzzy Association, vice persident of the IFSA, IEEE IES Senior AdCom member.

János Bitó is the member of the MAB Committee on Informatics- and Electrical Engineering Sciences.

János Fodor and Aurél Galántai are members of the Operation Research Committee at the Mathematics Department of the Hungarian Academy of Sciences.

János Fodor is the co-president of the Hungarian Fuzzy Association, co-president of the EUROFUSE EURO Working Group on Fuzzy Sets, jury member of the OTKA ELE.

József K. Tar is the president of the IEEE IES and RAS Hungary (Industrial Electronics and Robotics & Automation Societies Joint Chapter of IEEE HS) Chapter, the member of the MAB Sub-Committee of Machine Systems of the Committee of Engine Structures of the Hungarian Academy of Sciences.

László Horváth is the secretary of the IEEE SMC Hungary Chapter.

The staff take an important role as members of various IEEE engineering associations' sub-committees in furthering international connections of this region and its scientific life. They are the core of the Hungarian Fuzzy Association, and were acted a crucial role in its founding and operation.

As members of the John von Neumann Computer Society they are able to regularly inform the Hungarian scientific public about the ongoing scientific activities of the institute.

Organization of Conferences, International Co-operation

The staff members of the Institute of Intelligent Engineering Systems have acted as members of conference committees 12 international conferences in the past years. At 14 international conferences they took up positions as chair, co-chair, or committee chair. To name a few: the European Conference on Operational Research, the Linz Seminar on Fuzzy Sets and Systems with its 27 year-long past, the INES (IEEE International Conference on Intelligent Engineering Systems), the RAAD (International Workshop on Robotics in Alpe-Adria-Danube Region), the

ICCC (IEEE International Conference on Computational Cybernetics), IEEE International Conference on Systems, Man & Cybernetics (SMC), IEEE International Conference on Intelligent Systems Design and Applications (ISDA), International Conference on Advanced Robotics (ICAR), IEEE International Workshop on Soft Computing Applications, SOFA 2005, ICM (IEEE International Conference on Mechatronics).

The International Symposium of Hungarian Researchers on Computational Intelligence, (http://www.bmf.hu/conferences/huci2006) was started 7 years ago under the leadership of Imre J. Rudas and János Fodor as the heads of the Science Committee of the Budapest Tech. Every November there is symposium organized in recognition of the Hungarian Day of Science. This symposium enables researchers to publish their results of the past year, as well as provide a meeting opportunity for researchers from within and without the borders of Hungary. The proceedings of this conference is published in English, though the presentations are given in Hungarian, furthering by this the use of Hungarian terminology. Each year the members of this institute participate in this event. Among others, at such symposium was the book of György Bárdossy, member of the Hungarian Academy of Sciences and János Fodor on modern mathematical models applied in geological research first presented:
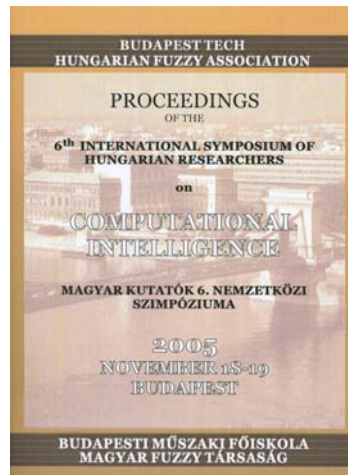
[23] Gy. Bárdossy, J. Fodor: *Evaluation on Uncertainties and Risks in Geology*, Springer, 2003, ISBN 3-540-20622-1.

The researchers and professors of the Budapest Tech have had a long-standing successful co-operation with Hungarian researcher outside the borders of Hungary. As a result of this a series of bilateral symposiums have been organized on the topic of intelligent systems, engineering models and applied mathematics, in which the members of this institute play a vital role. These meetings started four years ago, and have by now outgrown the form of causal meetings, there are more than 60 submitted papers and at least as many participants at these conferences. These symposiums present a useful possibility for young researchers to present themselves in front of an international public, and to establish personal contacts leading to future co-operation in the fields of education, research and scientific projects.

Four of the members of staff have participated both at the SAMI 2006 (4th Slovakian-Hungarian Joint Symposium on Applied Machine Intelligence) held in Herlany, Slovakia and at the SACI 2006 (3rd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence) held in Timisoara, Romania.

The symposium held in Subotica, Serbia SISY 2006 (4th Serbian-Hungarian Joint Symposium on Intelligent Systems) was to a great degree organized by the staff of the Institute of Intelligent Engineering Systems. The latter two conferences the researches of this institute presented the work conducted at the institute's workshops in a special section.

These conferences and bilateral international Tét projects would not have been organized had the members of the institute's staff not had successful professional connections among others at the University of Novi Sad, Serbia, Polytechnical Engineering College, Subotica, Serbia, the University of Timisoara, and Cluj-Napoca, Romania, the University of Varazdin (Croatia), Košsice and Bratislava, in Slovakia.

Summary

The Institute of Intelligent Engineering Systems is a fairly young institute of the Budapest Tech, but it gathers scientists with significant research and lecturing experience. But the ongoing co-operations taking place at the institute's workshops are likely to further these scientific carriers. The planned and already conducted base research will find its application in future R&D activities, within the industry or other areas. All these features provide the background to Masters and PhD courses, not only according to the requirements of the Hungarian Accreditation Committee, but in the sense of training future instructors and researchers.