



IntelliCIS COST ACTION IC0806

Intelligent Monitoring, Control and Security of Critical Infrastructure Systems

3rd Action Workshop

23-24 September 2010,

Novi Sad, Serbia

INTELLICIS ACTION IC0806 – PROGRAM-AT-A-GLANCE

Thursday, 23 September 2010	
09:00 – 10:00	KEYNOTE LECTURE: Marios Polycarpou
10:00 – 10:30	COFFEE BREAK
10:30 – 11:20	Tutorial I: Telecommunication networks
11:20 – 12:10	Tutorial II: Electric Power Systems
12:10 – 12:30	Presentation I
12:30 – 14:00	LUNCH
14:00 – 16:00	Breakout sessions
16:00 – 18:00	IC0806 Management Committee Meeting
19:00 – 22:00	DINNER

Friday, 24 September 2010	
09:00 – 10:00	KEYNOTE LECTURE: Avi Ostfeld
10:00 – 10:30	COFFEE BREAK
10:30 – 11:20	Tutorial III: Water systems
11:20 – 13:00	Presentations II-V
13:00 – 14:30	LUNCH

INTELLICIS ACTION IC0806 – DETAILED PROGRAM

Thursday, September 23

9:00 AM - 10:00 AM

KEYNOTE LECTURE

"A fault diagnosis framework for intelligent monitoring of critical infrastructure systems," Marios Polycarpou (University of Cyprus, Cyprus)

Conference Room

Chair: Elias Kyriakides (University of Cyprus, Cyprus)

10:00 AM -10:30 AM

COFFEE BREAK

10:30 AM - 11:20 AM

Tutorial I: "Telecommunication networks," Jens Myrup Pedersen (Aalborg University, Denmark)

Conference Room

Chair: Cesare Alippi (Politecnico di Milano, Italy)

11:20 AM - 12:10 PM

Tutorial II: "Electric power systems," Elias Kyriakides (University of Cyprus, Cyprus)

Conference Room

Chair: Cesare Alippi (Politecnico di Milano, Italy)

12:10 PM - 12:30 PM

Presentation I: "Early warning methodology for monitoring and operational management of drinking water distribution systems," Anatolijs Zabašta (Riga Technical University, Latvia)

Conference Room

Chair: Cesare Alippi (Politecnico di Milano, Italy)

12:30 PM – 2:00 PM

LUNCH

2:00 PM – 4:00 PM

Breakout sessions

Breakout session 1: Real-time Water Quality Management in Water Distribution Networks

Room 319

Chairs: Marios Polycarpou (University of Cyprus, Cyprus) and Dragan Savic (University of Exeter, United Kingdom)

Breakout session 2: Wide Area Measurement and Control in Power Systems

Room 124

Chairs: Vladimir Terzija (University of Manchester, United Kingdom) and Elias Kyriakides (University of Cyprus, Cyprus)

4:00 PM – 6:00 PM

IC0806 Management Committee Meeting

Conference Room

7:00 PM – 10:00 PM

DINNER

Friday, September 24

9:00 AM - 10:00 AM

KEYNOTE LECTURE 2

“Drinking water distribution systems security modeling: review and challenges,” Avi Ostfeld
(Technion - Israel Institute of Technology, Israel)

Conference Room

Chair: Elias Kyriakides (University of Cyprus, Cyprus)

10:00 AM - 10:30 AM

COFFEE BREAK

10:30 AM – 11:20 AM

Tutorial III: “Water distribution systems,” Dragan Savic, University of Exeter, United Kingdom

Conference Room

Chair: Attila Vidács (Budapest University of Technology and Economics, Hungary)

11:20 AM – 13:00 PM

Presentations II-V

Conference Room

Chair: Attila Vidács (Budapest University of Technology and Economics, Hungary)

Temporal data clustering and natural inspired computation

Ke Chen (The University of Manchester, United Kingdom)

Health aspects on the water network

Annika Malm (Chalmers University of Technology & Gothenburg Water, Sweden)

A large scale WSN-based forest fire sensing and management system

Evangelia Kolega (National Technical University of Athens, Greece)

On specification process of dependable MAC protocol for CIP related applications

Evgeny Osipov (Luleå University of Technology, Sweden)

13:00 PM – 2:30 PM

LUNCH

A Fault Diagnosis Framework for Intelligent Monitoring of Critical Infrastructure Systems

Marios Polycarpou

**KIOS Research Center for Intelligent Systems and Networks
Department of Electrical and Computer Engineering
University of Cyprus, Cyprus**

Abstract: Modern societies have reached a point where everyday life relies heavily on the reliable operation and intelligent management of critical infrastructures, such as electric power systems, telecommunication networks, water systems, and transportation systems. The design, control and fault monitoring of such systems is becoming increasingly more challenging as their size, complexity and interactions are steadily growing. Moreover, these critical infrastructures are susceptible to natural disasters, frequent failures, as well as malicious attacks. There is a need to develop a common system-theoretic framework for modeling the behavior of critical infrastructure systems and for designing algorithms for intelligent monitoring, control and security of such systems. The goal of this presentation is to motivate the need for health monitoring, fault diagnosis and security of critical infrastructure systems and to provide a methodology for detecting, isolating and accommodating both abrupt and incipient faults in a class of complex nonlinear dynamic systems. A detection and approximation estimator based on computational intelligence techniques is used for online health monitoring. Once a fault is detected, a bank of isolation estimators is activated for the purpose of fault isolation. A key design issue is the adaptive residual threshold associated with each isolation estimator. Various adaptive approximation techniques and learning algorithms will be presented and illustrated, and directions for future research will be discussed.

Biography: Marios M. Polycarpou is a Professor of Electrical and Computer Engineering and Director of the KIOS Research Center for Intelligent Systems and Networks at the University of Cyprus. He received the B.A. degree in Computer Science and the B.Sc. degree in Electrical Engineering both from Rice University, Houston, TX, USA in 1987, and the M.S. and Ph.D. degrees in Electrical Engineering from the University of Southern California, Los Angeles, CA, in 1989 and 1992 respectively. In 1992, he joined the University of Cincinnati, Ohio, USA, where he reached the rank of Professor of Electrical and Computer Engineering and Computer Science. In 2001, he was the first faculty and the founding department Chair of the newly established Electrical and Computer Engineering Department at the University of Cyprus. His teaching and research interests are in intelligent systems and control, adaptive and cooperative control systems, computational intelligence, fault diagnosis and distributed agents. Dr. Polycarpou has published more than 200 articles in refereed journals, edited books and refereed conference proceedings, and co-authored the book *Adaptive Approximation Based Control*, published by Wiley in 2006. He is also the holder of 3 patents. Prof. Polycarpou has served as the Editor-in-Chief of the *IEEE Transactions on Neural Networks* between 2004-2010. He served as Associate Editor of the *IEEE Transactions on Neural Networks* (1998-2003) and the *IEEE Transactions on Automatic Control* (1999-2002), as the Chair of the Technical Committee on Intelligent Control, IEEE CSS (2003-05), and as Vice President for Conferences, of the IEEE Computational Intelligence Society (2002-03). He is currently an elected member of the Board of Governors of the IEEE Control Systems Society, an elected AdCom member of the IEEE Computational Intelligence Society, and the Chair of Awards Committee for the IEEE Computational Intelligence Society. He has been invited as Keynote Plenary Speaker at more than ten international conferences during the last three years and is currently an *IEEE Distinguished Lecturer* in computational intelligence. Dr. Polycarpou is a Fellow of the IEEE.

Early warning methodology for monitoring and operational management of drinking water distribution systems

Anatolijs Zabašta

Riga Technical University

Abstract:

Nowadays, there is a growing need to develop appropriate methods to acquire, process and interpret large amounts of data in real time to assist the decision making process for optimal drinking water distribution systems management. The presented methodology is designed as early warning systems to prompt the appropriate response to eliminate or mitigate contamination events occurred.

Information gathered from the field, including near real-time pressure and flow data and customer contacts, is combined in order to identify the most likely locations of failures. Furthermore, the impact of potential failures is evaluated using a set of proposed operational impact factors based on the outputs from a pressure-driven hydraulic model

One of the main benefits of the methodology presented here is that it enables operators to become more effective and efficient in emergency conditions.

Finally challenges and opportunities of continuous monitoring aiming to better manage drinking water systems operation will be discussed.

Biography:

During 2004-2009 A.Zabašta managed Electronic Government department at the Secretariat of eGovernment Affairs of Latvia, which was responsible for coordination of ICT implementation in public governance institutions of Latvia. A.Zabašta was responsible for elaboration of Latvia eGovernment Development Plan 2005-09. The team leading by A.Zabašta in 2005-2009 implemented several projects that resulted in creation the first national public e-services portal www.latvia.lv and state information systems integrator, which enables to develop first cross institution e-services for business and consumers. Several research studies aiming to identify threats and provide recommendation to secure information systems of public governance institutions was initiated by A.Zabašta.

In 2004-09 he was a member of eGovernment working group leading by DG INFSO of European Commission resolving the issues of security of IS, cross border e-services and future technologies for e-government.

In 2009 he joined to Micro Dators, which provides research and piloting in the field of monitoring and operational management of water distribution systems using ICT tools. In 2009-10 in cooperation with Ventspils High Technology Park he managed a project aiming to make a study of water distribution networks in Kurzeme Region of Latvia and to recommend a model for monitoring and control of water distribution systems using ICT tools. In 2010 together with Ventspils University College he participates in the piloting of the model for monitoring and control of water distribution system in Kurzeme Region and participates in elaboration of the project WIRELESS-M-NET of EUREKA Eurostars program.

A.Zabašta holds MSc degrees in Management Information Systems (in 2000), Business Administration (in 2004) and a primary degree in Telecommunication Engineering. Since 2010 he studies Computerised control of electrical Technologies at Riga Technical University, Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering with the purpose to obtain PhD degree.



Drinking Water Distribution Systems Security Modeling: Review and Challenges

Avi Ostfeld

**Associate Professor, Faculty of Civil and Environmental Engineering, Technion-Israel
Institute of Technology, Haifa 32000, ISRAEL**

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Abstract:

Since the events of 9/11 2001 in the US the world public awareness to possible terrorist attacks on water supply systems has increased dramatically, causing the security of drinking water distribution systems to become a major concern around the globe. Among the different threats to water distribution systems, a deliberate chemical or biological contaminant intrusion is considered the most difficult threat to address, both because of the uncertainty of the type of the injected contaminant and its consequences, and as of the uncertainty of the location and injection time. This talk reviews the state of the art on drinking water distribution systems security modeling and points out new challenges in this area.

Biography:

Avi Ostfeld is a member of the Faculty of Civil and Environmental Engineering at the Technion-Israel Institute of Technology as of October 2000. Dr. Ostfeld was a Senior Engineer and Project Manager at TAHAL-Consulting Engineers Ltd. in Tel-Aviv, Israel from November 1997 to September 2000; a Research Associate at the Department of Civil Engineering, the University of Arizona, Tucson, AZ, USA, from September 1996 to September 1997; and a Research Associate at the Water Research Institute, Technion, Haifa, Israel from April 1994 to July 1996. He received his D.Sc at the Technion-Israel Institute of Technology in 1994. In March 2007 he received tenure at the Technion as a Senior Lecturer. From April to October 2008 he spent a sabbatical as a Visiting Professor, at the Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign. Recently he was invited to spend the summer of 2009 at the Research Center for Environmental Quality Management, Graduate School of Engineering, Kyoto University, Japan. In June 2009 he was promoted to Associate Professor. Dr. Ostfeld's research contributions and professional activities are in the fields of water resources systems, hydrology, and in particular in the area of water distribution systems optimization using evolutionary computation: water distribution systems security through optimal monitoring and booster chlorination station allocations, optimal design and operation of water distribution systems, and integrating water quality and reliability into water distribution systems management and control.

Temporal Data Clustering and Natural Inspired Computation

Ke Chen

School of Computer Science, The University of Manchester, U.K.

Abstract:

Temporal data clustering provides underpinning techniques for discovering the intrinsic data structure and condensing/summarising information conveyed in temporal data. Such techniques are demanded in various fields including the intelligent monitoring, control and security of critical infrastructure systems. In this presentation, I shall present a novel temporal data clustering framework via weighted clustering ensemble on different temporal data representations where I shall describe the enabling technique, our weighted clustering ensemble algorithm, and report favorite results in real world temporal data clustering tasks such as motion trajectory and time series data stream clustering analysis. On the other hand, nature inspired methodologies provide an alternative yet promising way to cope with complex systems and AI problems including clustering analysis. Although natural inspired computing techniques have been successful in various applications, there are many issues to be studied. As a result, we wish to draw colleagues' attention to this emergent field in order to gauge the interests in establishing an international training network of nature inspired approaches to critical infrastructure systems under the FP7 Marie Curie Initial Training Network Program.

Biography:

Ke Chen received BSc and MSc from Nanjing University in 1984 and 1987, respectively, and PhD from HIT in 1990, all in Computer Science. He has been with The University of Manchester since 2003. He was with The University of Birmingham, Peking University, The Ohio State University, Kyushu Institute of Technology, and Tsinghua University. He was a visiting professor at Microsoft Research in 2000 and Hong Kong Polytechnic University in 2001. He has been on the editorial board of several academic international journals including IEEE Transactions on Neural Networks (2005-2010) and serves as the category editor of Pattern Recognition in Scholarpedia (2006-present). He has served as a technical program co-chair of several international conferences, e.g., IJCNN (2012) and ICNC (2005), and a member of the technical program committee of numerous international conferences such as CogSci and IJCNN. In 2008 and 2009, he chaired Intelligent Systems Applications Technical Committee (ISATC) and University Curricula Subcommittee, IEEE Computational Intelligence Society (IEEE CIS). He also served as task force chairs and a member of NNTC, ETTC and DMTC in IEEE CIS. He is a senior member of IEEE and was a recipient of several academic awards including the NSFC Distinguished Principal Young Investigator Award and JSPS Research Award. He has published over 100 academic papers in refereed journals and conferences. His current research interests include pattern recognition, machine learning, machine perception and nature inspired computation and applications to real world problems.

Health aspects on the water network

Annika Malm

Chalmers Univ. of Tech. & Gothenburg Water

Abstract:

Disturbances in water quality are often related to water sources and waterworks, but the distribution system has a significant impact of the water quality. Studies reports 20-40 % of outbreaks are related to the distribution system. Moreover, far from all disturbances in water quality is reported to administration offices or is paid attention to even locally. It is difficult to measure the extent of incidents of poor water quality and how many cases of illness not paid attention to. One step closer is to study the amount of people who have sought health centers or medical information by telephone for stomach complaints. Together with epidemiologic specialists at Umeå University, Sweden, Chalmers will study the possible correlation between people sought health care and events on the water network. Another approach is to measure water quality and gastrointestinal illness during pipe break repairs. A study in Gothenburg has started where water samples will be analysed and questionnaires sent out.

Biography:

Born 1970. MSc Industry based PhD student at Chalmers University of Technology since 2008. Since 1999, employed at Gothenburg Water, a Dept. of Gothenburg City. Gothenburg Water provides water to the municipality and takes care of the sewage. For me, renewal strategies of water and sewer network is the present main work, including PhD studies 50% of time.



A Large Scale WSN-based Forest Fire Sensing and Management System

Evangelia D. Kolega

National Technical University of Athens, Greece

Abstract:

In this paper we suggest an application platform for developing a Fire Sensing Management System based on WSNs and further discuss decision support that can be based on such a platform and application software. The use of such a system can assist the appropriate authorities detect a forest fire incident in the very beginning and assess the relative severity of simultaneous forest fire incidents in order to decide how to best exploit available resources. Wireless Sensor Networks (WSNs) play a fundamental role in the implementation, being the in-situ detection mechanism. The Management and Decision Support System does the collection of network data, the depiction of temperature values on platforms such as Google maps, and the assessment of the relative severity of simultaneous fire fronts using forest fire simulation. It can also send real-time alarm messages, so that immediate action is undertaken by the crisis management authorities.

Biography:

Evangelia Kolega is a Phd candidate at the National Technical University of Athens (NTUA). Her main research issues are WSN applications, especially focused on environmental engineering, modeling and crisis management. She is currently a research fellow at National Hazards Centre of NTUA. Eva received the MSc degree in Networked Information Systems from the University of Piraeus and the Diploma in Electrical and Computer Engineering from the NTUA, Athens, Greece. She has worked for about 15 years as a network engineer and researcher for network companies, academic and research institutions. Some of them are the Greek Research and Technology Network (GRnet), the Computer Technology Institute of Patreus, the Network Operations Centre (N.O.C.) of the University of Piraeus and the N.O.C. of Technological Educational Institute (T.E.I.) of Athens. Eva has participated in a number of well known national network projects and in EU ones such as RESMA and EMEA. She has written four papers for conferences published in their proceedings.

On specification process of a dependable MAC protocol for two real-world WSN applications

Evgeny Osipov

Luleå University of Technology, Sweden

Abstract:

Currently, when matter comes to engineering a communication system for a new WSN application with a unique set of dependability requirements, the developer should undergo a lengthy process of analyzing the existing solutions in order to select appropriate functionality. In this talk we argue that in the light of variety of wireless sensor network applications there is a clear need for a systematic approach to design of application-tailored communication solutions. The core of this methodology should constitute functional components with known reliability and security properties and the rules of combining these components into an application-tailored communication system. On an example of engineering MAC layer functionality for two real world applications we demonstrate a line of dependable reasoning and identify the simplest in its class component, which satisfy the dependability requirements of the applications.

Biography:

Dr. Evgeny Osipov received the M.Sc. degree from EPFL, Swiss Federal Institute of Technology in 1999, Licentiate of Engineering from KTH, Royal Institute of Technology, Sweden in 2003 and PhD in Computer Science from University of Basel, Switzerland in 2005. He worked as a senior researcher at RWTH Aachen University in Germany before joining Luleå University of Technology in Sweden. Presently he is an Associate Professor and a head of the networking group in the Department of Computer Science and Electrical Engineering at LTU. He was involved in several EU projects both as a researcher and a technical coordinator. His PhD work is in the domain of traffic analysis and routing protocols in multihop wireless networks. His major research interests are in design principles of dependable communication architectures for wireless sensor and computer networks.