

Editor

Sumanth Yenduri



ADVANCES IN COMPUTER SCIENCE

**Proceedings of the 6th WSEAS European Computing Conference
(ECC '12)**

Prague, Czech Republic, September 24-26, 2012



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Prof. Sumanth Yenduri, The University of Southern Mississippi, USA.

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Preface

This year the 6th WSEAS European Computing Conference (ECC '12) was held in Prague, Czech Republic, in September 24-26, 2012. The conference provided a platform to discuss network design, wireless networks, protocols and applications, software engineering, databases, development and simulation etc with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conference are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

OptimalSQM: Optimal Software Quality Management Repository is a Software Testing Center of Excellence



Assistant Professor Ljubomir Lazic

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Abstract: Development of quality software is very complicated and unreliable task, but the management of software development and testing process (SDP-STP) is much harder without appropriate software environment consisting of integrated techniques, procedures and tools for: a) precise planning (resources, costs, duration, training, etc.), b) software project risk identification, estimation and control, c) software quality metrics and measurement establishment, d) process testing quantitative management, i.e. management of activities needed for software quality assurance in order to increase efficiency of software bugs detection and removal. Our OptimalSQM Framework solution is based on a Business Intelligent Simulation Architecture (BISA) with integrated Software expert tools (Profit eXpert, Planer eXpert, Risk Management eXpert, Quality eXpert, Maintenance eXpert, People Performance eXpert and Process Dynamics Control eXpert) to find optimal development activity combination at the beginning for every SDLC model. The BISA architecture is coherent, balanced and improved version of OptimalSQM (partially defined in our former projects), providing the full service spectrum that satisfy the highest maturity level (4 and 5) of SPD-SPT according to SEI CMM and TMM methodologies. The BISA realization with complete integrated expert tools will offer to SMEs the following: 1) Web portal-repository of the best models and techniques from practice, all integrated into optimized and quantity driven software testing and maintenance process; 2) Automatic process planning based on models for software volume, cost, number of designers, duration, etc. estimation; 3) Environment for computer-aided experimenting based on principles of planned experiment with rules by wizards; 4) The environment for scenario of qualitative software development simulation that allows cost and risk minimization by alternative testing plans choice, which satisfy constraints related to free resources, optimization criteria and performances of a company; 5) Economical model of software quality for SQA activities evaluation of the investment benefit, measures that should be taken in order to improve software process development and testing (SPD-SPT) based on economical parameters (ROI, BCR, CAPEX, OPEX, etc.); 6) Balanced productivity metrics based on Balanced Scorecard methodology an 6-Sigma strategy for constant SDP-STP improvement; 8) Web-based GUI development; 9) Data and documents sharing with standard working environments of team members, like MSOffice and MSProject, etc. OptimalSQM solution aim is to assist with advanced software testing technology adoption in organizations, especially focusing on small- to medium-sized enterprises (SMEs) i.e. OptimalSQM solution is a Software Testing Center of Excellence for SMEs.

Brief Biography of the Speaker:

Ljubomir Lazic graduated from the University Electrical Engineering School, Serbia in 1979. In the 1980s he worked as Embedded Software and Hardware Test Engineer, Test Manager and Senior Researcher at Military Technical Testing Center (MTTC). He was a member of MTTC's Scientific Council, Belgrade, Former Yugoslavia and ICT Military Expert at Yugoslav Army Headquarters. Also in the 1990s, he has been working for a local telecommunications SIEMENS Company in Belgrade as Chief Engineer in Sales & Marketing Division, Installation & Commissioning Manager and Maintenance Manager. He continued to serve industry in a variety of roles, including consulting, executive education, and expert testimony. He is docent in Computer Science at the State University of Novi Pazar, Serbia (2007- current), and docent in Software Engineering, University Union of Belgrade (2006-2010). His research interests are in Software Engineering, Software Project Management, Software Testing, Human Computer Interaction, and Component Based Engineering. Current research interests, doing as a Project leader, in two projects supported in part by the Ministry of Science and Technological Development of the Republic of Serbia under Grant No. TR-1318 (2008-2011) and TR-35026 (2011-2014) are: Optimal software project management, Software Metrics, Effort Estimation Modeling etc. He is author of about 90 papers published in international journals and conference proceedings, invited speaker (Keynote speaker at QA&TEST 2010, 9th International Conference on Software QA and Testing on Embedded Systems, 27-28-29 October - Bilbao, Spain, 2010) and book chapters.

Plenary Lecture 2

Artificial Bee Colony (ABC) Algorithm with Crossover and Mutation



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Abstract: Combinatorial and continuous hard optimization problems were recently successfully approached by nature inspired metaheuristics. Swarm intelligence represents an important subclass of nature inspired algorithms and artificial bee colony (ABC) is one of its relatively new members. For all such heuristically guided search algorithms, balance between exploitation and exploration is most important. If that balance is not achieved the algorithm can be (by too much exploitation) prematurely trapped in local optima, or it can (by too much exploration) avoid convergence similarly to pure Monte Carlo search. It is generally considered that employed bees and onlooker bees in the ABC algorithm perform exploitation, while scout bees perform exploration. We have shown that the real situation is more complicated: some exploration is actually done by the employed bees and a way in which a new candidate solution is generated is of crucial importance. Previously we improved the ABC algorithm for a class of problems by limiting the new solution location from the hyper-cube to the diagonal and its projections between two existing solutions. Here we introduce new solution generation with a technique similar to the crossover from genetic algorithms and show additional improvement in the ABC algorithm. Also, in the scout phase random solution generation can successfully be replaced by a controlled mutation.

Brief Biography of the Speaker:

Milan Tuba is Professor of Computer Science and Provost for mathematical, natural and technical sciences at Megatrend University of Belgrade. He received B. S. in Mathematics, M. S. in Mathematics, M. S. in Computer Science, M. Ph. in Computer Science, Ph. D. in Computer Science from University of Belgrade and New York University. From 1983 to 1994 he was in the U.S.A. first as a graduate student and teaching and research assistant at Vanderbilt University in Nashville and Courant Institute of Mathematical Sciences, New York University and later as Assistant Professor of Electrical Engineering at Cooper Union Graduate School of Engineering, New York. During that time he was the founder and director of Microprocessor Lab and VLSI Lab, leader of scientific projects and supervisor of many theses. From 1994 he was Assistant Professor of Computer Science and Director of Computer Center at University of Belgrade, from 2001 Associate Professor, Faculty of Mathematics, and from 2004 also a Professor of Computer Science and Dean of the College of Computer Science, Megatrend University Belgrade. He was teaching more than 20 graduate and undergraduate courses, from VLSI Design and Computer Architecture to Computer Networks, Operating Systems, Image Processing, Calculus and Queuing Theory. His research interest includes mathematical, queuing theory and heuristic optimizations applied to computer networks, image processing and combinatorial problems. He is the author or coauthor of more than 130 scientific papers and coeditor or member of the editorial board or scientific committee of number of scientific journals and conferences. Member of the ACM since 1983, IEEE 1984, New York Academy of Sciences 1987, AMS 1995, SIAM 2009.

Plenary Lecture 3

Multidimensional Optimization Problems in Tropical Mathematics with Applications to Location Analysis



Associate Professor Nikolai Krivulin
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Abstract: We consider multidimensional optimization problems that are formulated in the tropical (idempotent) algebra setting. The problems under study are to minimize nonlinear functionals defined on finite-dimensional semimodules over idempotent semifields, and they may have additional constraints imposed on the feasible solution set in the form of linear equations and inequalities. We start with a brief introduction into idempotent algebra, and then overview preliminary results including solutions to linear equations and eigenvalue-eigenvector problems to provide a framework for further results. Furthermore, we examine unconstrained problems and give general comprehensive solutions to the problems in a closed-form. These solutions are then extended to handle certain constrained problems. Finally, the above results are applied to both unconstrained and constrained multidimensional minimax single facility location problems with Chebyshev and rectilinear distances.

Brief Biography of the Speaker:

Nikolai Krivulin received a university degree in applied mathematics and operations research in 1983 from St. Petersburg State University (SPbSU). He got his Ph.D. degree in 1990 and D.Sc. degree in 2010 both in applied mathematics from SPbSU. In 1983 he joined the Computer Center at SPbSU as a system software engineer, and in 1985 started his Ph.D. study. In 1987 he joined the Faculty of Mathematics and Mechanics at SPbSU as an Assistant Professor, and became an Associate Professor in 1990. From 1999 to 2002 he was the head of the Department of Information Management in the Graduate School of Management at SPbSU. He is currently an Associate Professor of the Department of Statistical Modelling at St. Petersburg State University. His research interests include theory and applications of idempotent algebra, modelling and performance evaluation of queueing systems, methods of optimization, computational statistics and computer simulation. He is author and coauthor of more than 70 papers in reviewed journals and conference proceedings, books chapters, textbooks, and a monograph. He was a grantee of national and international foundations, including the Russian Foundation for Basic Research, the Russian Foundation for Humanities Research, the NATO Science Foundation, the USIA and Eurasia Foundation (USA), and the Royal Society (UK). He served as a member of program and organizing committees of international conferences on mathematics, computer sciences, and information technology. He is a member of the St. Petersburg Mathematical Society, AMS, and SIAM.

Plenary Lecture 4

Performance Management Systems (PMS) Construction and Analysis



Professor Jiří Strouhal

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Abstract: Many references can be found in literature indicating that there have been difficulties in implementation of performance management systems (PMS) not allowing to gain the full benefit from the system (Business Intelligence, 2000; Kaplan and Norton, 2000). There are certainly many success stories, but there is now growing literature addressing the difficulties of implementation and it is claimed by some that 70 per cent of performance measurement initiatives fail (McCunn, 1998). The same rate (70%) marks failures of Balanced Scorecard (BSC) implementation (Neely and Bourne, 2000). Waal (2002) says that 56% of performance management projects fail. Research studies have shown that PMS implementation in industry still lags far behind expectations (Olsen et al., 2007). Insufficient implementation and/or lack of inefficient PMS may lead to the poor organisational performance and on the contrary.

The two institutions LGMB and the Audit Commission in the UK suggest that, in order to improve both organisational and individual performance, the following management functions are important: (i) defining and setting organisational and individual aims and objectives; (ii) corporate planning; (iii) linking organisational strategy and service objectives to jobs and clients; (iv) identifying staff training and development needs; (v) assessing the results through personal appraisal using relevant performance indicators; (vi) performance agreements or contracts; (vii) using the knowledge gained through training to modify performance attitudes; (viii) external and internal communication systems; (ix) organisation development and performance review.

There are studies which have examined the current use of performance management. It has been pointed out that 56% of performance management projects fail, especially in the functioning phase (Waal, 2002; Waal and Counet, 2006). This implies that the functioning phase is not less important than the structural design phase. Regular activities which constitute the functioning of PMS are: data collection, analysis, drawing up and presenting reports, communication, interpreting, managers and top level must peruse reports, react to them, feedbacking with "carrot and stick" judgement is important, planning of adjusting activities (with new KPI target values), executing of adjusting activities (the new activities probably involve that post-strategy actions will be somewhat influenced by them and they need to be adjusted slightly in the new light).

PMS functioning classically starts when implementation ends and operation by "new rules" begins. In reports milestones set in the PMS structure, their achievement and communication of results are monitored.

Brief Biography of the Speaker:

Jiří Strouhal graduated from the University of Economics Prague in 2003 and finished his doctoral studies in 2005. In 2006 he became an accounting expert (Czech accounting profession certification scheme based on British ACCA curricula). In the period 2007 – 2009 he was member of the Committee for Education and Certification of Accountants Czech Republic and Executive Board member of the Chamber of Certified Accountants (Union of Accountants CR). From 2011 he is President of Chamber of Certified Accountants Czech Republic and member of Accreditation Committee of this professional organization.

He is reputed academician and practitioner; he published more than 400 research outputs, from which could be stated 25 monographs in the area of accounting and corporate finance, more than 40 research papers published in reputed databases (ISI, SCOPUS – important piece of them in WSEAS/NAUN research journals). His SCOPUS H-index is 7 and his Google Scholar H-index is 10. His major is corporate financial reporting, partially focused on international accounting harmonization and financial securities reporting.

He was a plenary speaker of DEEE 2010 conference in Tenerife, E-ACTIVITIES 2011 conference in Jakarta, and conferences in Harvard (ICBA 2012) and Cambridge (EDUCATION 2012). Also did organized special sessions focused on measurement issues in finance and accounting at WSEAS conferences in Timisoara (EMT 2010), Iasi (AEBD 2011), Angers (EMT 2011), Harvard (ICBA 2012), Porto (AEBD 2012) and Zlin (FAA 2012). He was a chair of Zlin conferences which were held in September 2012 at Tomas Bata University in Zlin, Czech Republic.

Plenary Lecture 5

Intelligent Information Technologies Used for E-Learning Systems



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Abstract: Creating value people has become the primary objective of any learning systems. In reality, in the last time, this expression is hidden behind a lot of issues often overlooked. Using intelligent information technologies for e-learning systems we are building an information society, which can not be done without research and investment projects in education. Computers become more useful when artificial intelligence techniques are incorporated both in equipment and programs and the tasks are performed more effectively and at lower cost. Competence is the ultimate desire in Romanian higher education system and not even technologies or theories or other kind of approach will not eliminate/neglect professor-student relationship. In this paper, we will analyze the roles of intelligent information technologies used for higher education e-learning systems. Intelligent information technologies used for e-learning in Romanian higher education system are on stage of intensive development and probably each month, year and other period will bring new achievements in this field.

Brief Biography of the Speaker:

Badea Lepadatescu is currently an Associate Professor at the Faculty of Technological Engineering and Industrial Management of Transylvania University of Brasov, Romania. He obtained his doctoral degree in 1998 in the area of machining through superfinishing process. After he graduated he worked five years as design engineer at Roman truck factory in the field of manufacturing processes where he designed many devices and special machine tools especially for superfinishing process. Started on 1982 he worked as research engineer at Transilvania University of Brasov, and after 1997 he is teaching at Department of Manufacturing Engineering. His main academic interests include Tolerance and Dimensional Control, Manufacturing Engineering Processes, Automation Processes, and Renewable Energy Sources. The research accomplishments are reflected through publications in a five books and authored or co-authored over 120 papers published at international conferences. He has extensive experience in both experimental and theoretical research work having more than 50 contracts with factories to design and produce machine tools for machining processes. Also in the field of Renewable Energy Sources together with a team he made two wind turbines, one with horizontal axis for taking water, and one with vertical axis to produce electric energy. He has been speaker to international conferences, has moderated forums, organized symposia, workshops and sessions at major international conferences.

Plenary Lecture 6

Global Navigation Satellite Systems Applications in Modern Aviation and Terrestrial Applications



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Abstract: Global navigation satellite systems (GNSS) have become present in virtually all areas of social, commercial and private life. This technology became an essential component for modern navigation on land, water and air. Its use extended also to map making and land surveying and today's uses of it go further beyond the preliminary applications. Currently, we can talk about multiconstellation GNSS. It is composed not only of American GPS, but also of additional constellations used for corrections of the signal, such as for example: Wide Area Augmentation System (WAAS) in the USA, or European Geostationary Navigation Overlay Service (EGNOS) in Europe. It is also well known that European Union decided to launch its own GNSS program called Galileo, however it is still far from operational phase. Recently, Russia implemented its own GNSS called GLONASS and China develops system called BeiDou (Chinese name of the Big Dipper constellation used for navigation, and hence, having metaphoric meaning: Compass).

The plenary lecture presents applications of contemporary multiconstellation GNSS in aviation and terrestrial applications based research performed within the EGALITE project (www.egalite-project.eu) funded by European Union, whose foundations arose from EDCN (EGNOS Data Collection Network) and the ability offered by innovative Virtual Flying Laboratory (VFL) at Silesian University of Technology. The project started with enhancements of a software package for gathering in MS SQL database the high-throughput satellite navigation data, which is integrated with 3D visualization module GPS3D Viewer. The software package is also integrated with PEGASUS, a program authorized by EUROCONTROL organization. The database and the GPS3D Viewer are designed and functionally extended using the most recent software development technologies for continuous storing, administrating and post-processing of the EGNOS signal data. Their operation within distributed, Pan-European EDCN system has already made possible detection of important but rare events, such as sudden accuracy degradation, subject for further identification by EUROCONTROL, an organization responsible for the safe use of satellite navigation in European civil aviation. Additionally to single constellation signal, the more accurate localization can be achieved in Ground Based Augmenting System (GBAS) or Satellite Based Augmenting System (SBAS). The example of the first is the European Positioning (EUPOS) network delivering correction signals by radio, the example of the second is WAAS in the USA or EGNOS, a common project of European Union, European Space Agency (ESA) and European Organization for the Safety of Air Navigation (EUROCONTROL).

In the interdisciplinary EGALITE project, the innovative technologies originated from ICT are studied, varying from the on-ground precise positioning using GNSS and other sensors (for example in inertial navigation) as well as application of GNSS to vertical guidance in aviation in order to increase safety of the close-to-ground operations of helicopters. In such approach, it is necessary to consider the interplay of many qualitatively different factors, which act simultaneously and cause significant errors in positioning. The group of external factors such as architecture of GNSS systems in multiconstellation approach, influences the positioning accuracy by laws of physics, dynamics ionosphere and troposphere, and electromagnetic phenomena. The corrections of time scales caused by relativistic effects resulting both from Einstein's special and general (gravitational) theories of relativity have to be considered as well in any GNSS constellation. Additionally, internal factors, such as construction of the receivers, their ability of making use of augmentation signals, and computational algorithms applied are important for the final result of position measuring. Although mathematical models for positioning are generally known, the implementation of innovative computational algorithms can increase the accuracy in accordance with EUROCONTROL recommendations for the SBAS/EGNOS augmentation and the ionospheric range correction RCL1/L2.

As mentioned above, the performed research is using the capabilities of the Virtual Flying Laboratory (VFL) at SUT. It is an exceptional interdisciplinary laboratory, where cutting-edge technologies from aviation are combined with the newest trends in ICT, in particular, virtual reality and visualization, and with satellite navigation systems GNSS. VFL is co-financed by European Union from the European Regional Development Fund within the Project considered as a winner among more than 100 others in Silesia, the most industrial region in Poland. It is equipped with 14

professional flight simulators, including full-size cockpit simulators: two cockpit simulators: ELITE Evolution S812 and ELITE Evolution S923 equipped with 3-channel visualization technology, are compliant with JAR-STD 3A (Evolution S923 is additionally capable for MCC); two others, manufactured by FLYIT (FAA approved: PHS for helicopter and PAS for aircraft), are installed in mobile class-room platforms with heating and air-condition. Due to mobility, it is possible to move them to distant places where research and/or demonstration field experiments are planned. The instrumentation includes a full IFR panel with all engine and fuel gauges, engine/rotor RPM, AH, ALT, ROC, T&B, HSI, VOR, ADF, and Transponder. Engine gauges can be selected as reciprocating or turbine. The software includes Jeppesen 20,000 airport database, with associated Nav aids, and the entire earth surface with accurate elevation/obstructions. Software for PHS provides an accurate flight model including translation lift, ground effect, torque, auto-rotation for selectable 6 helicopter models: Piston R-22, R-44 (VFR-IFR), Schweizer 300 (VFR-IFR), Enstrom 280FX, Turbine-MD 500, Bell 206 (IFR). In stationary simulators such airplanes as Cessna 172RG, Piper Seneca III, Piper Arrow IV and King Air B200 are available. For all cockpit simulators, professional instructor command centres are supplied. Through command center, the operator can select any meteorological weather condition including precipitation, change clouds and wind direction and intensity at multiple elevations, record and replay flights, move a map, make a flight review, or print a flight path. Additionally, the professional GARMIN GNS430 original GNSS simulation devices are installed in stationary cockpit simulators, which, due to vertical navigation function, make possible to define various approaches, manoeuvres, and procedures based on GNSS. Particular problem of integration of flight simulator installed in VFL with the GNSS-based guidance system is described in more detail in a regular paper written by my colleagues and me: O. Antemijczuk, D. Sokolowska, K.A. Cyran, "Integration of the MS ESP flight simulator with GNSS-based guidance system", and presented at this conference separately.

Brief Biography of the Speaker:

Krzysztof A. Cyran graduated at Silesian University of Technology (SUT), Gliwice, Poland where he received his MSc degree in computer science (1992), PhD degree (with honours) in technical sciences (2000) and his DSc degree (habilitation) in technical sciences with specialty in computer science (2012). His PhD dissertation addresses the problem of automatic image recognition and his DSc dissertation concerns artificial intelligence, branching processes and coalescent methods in evolution of humans and early life. He has been an author and co-author of more than 100 publications with around 200 citations. Since 2012 he is an Associate Professor in the Institute of Informatics at SUT. Prof. Cyran (in 2003-2004) was a Visiting Scholar in Department of Statistics at Rice University in Houston, USA. After return from USA, he was the Vice-Head of the Institute of Informatics at SUT. Since 2011, he is the Director of the Virtual Flying Laboratory (VFL), the exceptional laboratory equipped with 14 professional flight simulators. The VFL has been co-funded by European Union, following favourable evaluation of Prof. Cyran's and Ms. Sokolowska's initiative to establish such laboratory in SUT to be a basis for performing research in the field of multiconstellation Global Satellite Navigation Systems (GNSS), including GPS, EGNOS and Galileo systems used in aviation. His current research interests are in image recognition and processing, artificial intelligence, digital circuits, decision support systems, rough sets, aviation and aeronautics, but he is interested also in computational population genetics and bioinformatics.

Prof. Cyran has been involved in numerous scientific grants awarded by Polish as well as European funds, including 7th Framework Program (7FP) of the European Union. In particular, he is the co-ordinator and the Scientist in charge in the EGALITE project. He is also local coordinator and Scientist in charge at SUT in SHERPA and HEDGE NEXT, the two others 7FP projects related to GNSS in aviation and implemented using professional VFL infrastructure. Prof. Cyran has received several awards of the Rector of the Silesian University of Technology for his scientific achievements, and he also has been rewarded by President of Poland for his scientific work at SUT. In 2004-2005 he was a member of International Society for Computational Biology. Currently he is a member of the Editorial Board of Journal of Biological Systems, member of the Scientific Program Committee of WSEAS international conferences in Malta (ECC'08), Rodos (AIC'08, ISCGAV'08, ISTASC'08) and multiconference in Crete (CSCC'08) as well as a reviewer for *Studia Informatica* and such journals indexed by Thompson Scientific as: *Optoelectronic Review*, *Mathematical Biosciences and Engineering*, *Journal of Biological Systems*, *Neurocomputing*, *Mathematical Problems in Engineering*, and *Engineering Applications of Artificial Intelligence*.