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30th International Conference on Software, Telecommunications and Computer Networks

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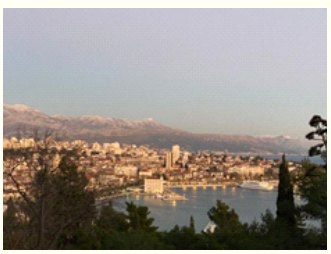
SoftCOM 2022

Split, Croatia
22 - 24 September, 2022

Final Program

SoftCOM 2022

22-24 September 2022 // Split // Croatia



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GENERAL CO-CHAIRS MESSAGE

Welcome Message

Dear participants and colleagues, it is our pleasure to welcome you to SoftCOM 2022 conference. We are excited to have an opportunity to take part in the organization of an international conference that gathers researchers and professionals from academia and industry to share experiences and new ideas in such a dynamic area as Information and Communication Technology.

Current and emerging information and communication technologies are key drivers of the information society and economy. With both evolving and new services we are enabling people to collaborate, innovate, learn, participate in ways we never thought possible. Through joint research and technology advancement we are opening ground for new discoveries and sustainable economic growth. We can shape the future global economy and society in ways that are equitable, inclusive, green, safe, and resilient. We have an opportunity for a systemic shift to a sustainable development that works for both people and the planet.

The 30th International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2022), technically co-sponsored by the IEEE Communications Society, will be held in the beautiful city of Split located on the magnificent Croatian Adriatic coast. It will be our pleasure to meet you at the conference.

Welcome!

Sinisa Krajnovic

Dinko Begusic

TEHNICAL PROGRAM CHAIRS MESSAGE

The 30th Conference on Software, Telecommunications and Computer Networks (SoftCOM 2022) will be held in a hybrid format, including live and virtual participation, in Radisson Blu Resort Split, Croatia, September 22 to 24, 2022.

Researchers and experts from industry, research institutes and universities from 42 countries all around the world have submitted their submissions for presentation at SoftCOM 2022. Submitted papers have been peer reviewed by scientists from universities, institutes and ICT companies. The accepted papers have been carefully selected based on their contribution, relevance, conceptual clearness and overall quality.

The technical conference program features nine general conference sessions and seven special sessions.

The special sessions are dedicated to hot topics including: QoS in Wired and Wireless Networks, Ad Hoc&Sensor Networks and Internet of Things, Security and Digital Forensics, Green Networking and Computing, Environmental Electromagnetic Compatibility, Robotics and ICT Assisted Wellbeing and Advanced Educational Technologies.

Besides that a Business Forum will be organized featuring invited talks, industrial panel, and workshops with participation of managers, experts, professionals and institutions' representatives. The 11th Workshop on Software Engineering in Practice has been organized by the research group from Ericsson Nikola Tesla company. The 21th Ericsson Nikola Tesla Summer Camp workshop provides the opportunity to students to promote their achievements and improve their innovations management skills.

On behalf of the Technical Program Committee we would like to thank and credit the authors for their excellent contributions. Particular thanks to the reviewers for their great job as well as to the IEEE Communications Society (ComSoc), Technical Committee of Communication Software for the support.

Technical Program Committee Co-chairs

Nikola Rozic, Pascal Lorenz

SoftCOM 2022 COMMITTEES

TECHNICAL PROGRAM COMMITTEE

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Matko Saric, University of Split, Croatia
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Vesna Roje, University of Split, Croatia
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SoftCOM 2022 Conference Secretary
Katarina Radoš, University of Split, softcom@fesb.hr

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FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE - FESB SPLIT

COMMUNICATIONS AND INFORMATION SOCIETY, CROATIA (CCIS)

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SoftCOM 2022 PROGRAM OUTLINE

Thursday, September 22, 2022 (hybrid)

08:00 – 09:00 Registration

09:00 – 10:30 Technical program, Professional program, Business forum

10:30 – 11:00 Coffee break

11:00 – 12:30 Technical program, Professional program, Business forum

12:30 – 14:30 Lunch

14:30 – 16:00 Technical program, Professional program, Business forum

16:00 – 16:30 Coffee break

Friday, September 23, 2022 (hybrid)

08:00 – 09:00 Registration

09:00 – 10:30 Technical program, Professional program, Business forum

10:30 – 11:00 Coffee break

11:00 - 12:30 Keynote speech

12:30 – 14:30 Conference Luncheon

14:30 – 16:00 Technical program, Professional program, Business forum

16:00 – 16:30 Coffee break

16:30 – 18:00 Technical program, Professional program, Business forum

18:00 – Social program

Saturday, September 24, 2022 (hybrid)

09:00 – 10:30 Technical program, Professional program, Business forum

10:30 – 11:00 Coffee break

KEYNOTE / INVITED SPEAKERS

KEYNOTE SPEECH KS1 Friday, September 23

11:00-11:45 (GRAND BALLROOM)

Elia Berteletti, PhD

Partner, McKinsey & Company

Yes!, Agile for hardware R&D really works

Abstract: Agile is a popular process for software development, yet it is increasingly being adopted for hardware development as well. We have led and learned from multiple Agile for hardware development transformations; in this note we share our perspective on why it works and what adjustments to the textbook Agile-for-software need to be made to make it work.

Elia Berteletti *is Partner at McKinsey & Company recently transferred to Seattle to lead the Operations in Technology group, previously spent 7 years in Taipei, Taiwan as leader of the Greater China Product Development and Procurement practice with a strong focus on (Digital) R&D, Agile R&D, Innovation and DtV/DtC, serving Clients in High-tech, Consumer electronics and Automotive and Assembly. Prior to McKinsey, spent 10 years at Toyota Motor Corporation R&D in Europe and in Japan, holds a Masters degree from Cornell University and UCL Louvain in Electronics Engineering. For more information, please visit the link.*

KEYNOTE SPEECH KS2 Friday, September 23

11:45-12:30 (GRAND BALLROOM)

Ante Mihovilovic, PhD

VP and Head of Product Development Unit Packet Core
Ericsson AB, Sweden

5G networks, impact on the industry and cloud-native transformation

Abstract: There has never been a more exciting time for the telecom industry than it is now. Today, we are witnessing the change that 5G technology brings to us, impacting all industries, enabling Industry 4.0, where the production is becoming automated, machine operating wirelessly and where operations are becoming smarter. This puts a lot of requirements on technology, from latency, security, AI/ML, as well as on speeds of network deployments of new capabilities. Technology foundations are changing and we are starting to see the full potential of cloud technologies, where the networks of today are becoming cloud-native, when only a few years ago the technology to achieve this was simply not existing. What impact does all this have on R&D organizations developing such products? What are the benefits? What are the expectations on the telecom products operating in this environment?

Ante Mihovilovic *graduated from University of Split, in the field of computer science. Straight after the university he joined Ericsson and started working with development of real-time software for Radio Access Networks. Over the next 17 years he worked in different management positions with development of Radio Access Networks, where he was in charge of research & development organisations across the globe (Sweden, Korea, Poland, China) responsible for development of software for UMTS, LTE and recently for 5G RAN. In that role he had a pleasure to work with many operators across the world and witness the change that mobile communications bring to society. He is currently VP and Head of Product Development Packet Core, focusing on the development of 5G Core Networks in the exciting period where the whole industry is going though a transformation towards the cloud-native.*

TECHNICAL PROGRAM: GENERAL CONFERENCE

Thursday, September 22, 14:30 - 16:00 (OLEANDAR)

S1/I: MACHINE LEARNING APPLICATIONS I

Chair: Matko Šarić, University of Split, Croatia

ATMAS: Airplane Trajectory Missing Alarm System based on Deep Learning
Qiaoqiao Zhu (Ocean University of China, China); Zexin Wu (Qingdao Air Traffic Management Station of Civil Aviation of China, China); Jie Nie (Ocean University of China, China)

Classification Algorithms for Analyzing Parkinson's Disease Patient
Osiris Escamilla-Luna, Miguel A. Wister and José Hernández Torruco (Universidad Juarez Autonoma de Tabasco, Mexico)

Siamese Network for Content-Based Image Retrieval: Detection of Alzheimer's Disease from Neuroimaging Data
Ivana Marin (University of Split, Croatia); Tea Marasović (FESB, Split, Croatia); Sven Gotovac (University of Split & FESB, Croatia)

Performance comparison of generic and quantized fully connected and convolutional neural networks for real-time signal/background classification
Arijana Mišura, Josip Music, Julije Ozegovic and Damir Lelas (University of Split, Croatia)

Individual Olive Tree Detection in RGB Images
Ivana Marin (University of Split, Croatia); Sven Gotovac (University of Split & FESB, Croatia); Vladan Papic (University of Split, Croatia)

Identifying low-resource languages in speech recordings through deep learning
Kleona Binjaku and Joan Janku (Polytechnic University of Tirana, Albania); Elinda Kajo Mece (Polytecnic University of Tirana, Albania)

Thursday, September 22, 11:00 - 12:30 (OLEANDAR)

S1/II: MACHINE LEARNING APPLICATIONS II

Chair: Damir Pintar (University of Zagreb, Croatia)

Analyses of Recent Advances on Machine Learning-based Trust Management for Mobile IoT Applications
Hiba Souissi, Michael Mahamat, Ghada Jaber, Hicham Lakhlef, and Abdelmadjid Bouabdallah (Universite de Technologie - Compiegne, France)

Comparison of Machine Learning Models for Predicting Indoor Materials from Channel Impulse Response
Teodora Kocevska (Jožef Stefan International Postgraduate School & Jožef Stefan Institute, Slovenia); Tomaz Javornik and Ales Svigelj (Jozef Stefan Institute, Slovenia); Ke Guan (Beijing Jiaotong University, China); Aleksandra Rashkovska (Jozef Stefan Institute, Slovenia); Andrej Hrovat (Jožef Stefan Institute, Slovenia)

Generative Recurrent Network For Design SARS-CoV-2 Main Protease Inhibitor
Adham Khaled Hassan and Zeinab Taha (October University for Modern Sciences and Arts, Egypt)

Machine Learning-based Model for Defining Circuit-level Parameters of VCSEL
Ihtesham Khan, Lorenzo Tunesi and Muhammad Umar Masood (Politecnico di Torino, Italy); Enrico Ghillino (Synopsys, Inc, USA); Vittorio Curri, Andrea Carena and Paolo Bardella (Politecnico di Torino, Italy)

ML-based Video Streaming QoE modeling with E2E and Link Metrics
Lei Wang, Adam Durning, and Declan Delaney (University College Dublin, Ireland)

Improving Classification Results in Network Data Analysis using Interpretability Methods
Domagoj Begušić (Neos Ltd., Croatia); Luke F Walker and Sanja Krznaric (University of Zagreb, Croatia); Damir Pintar (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia)

Selecting an Optimal Cluster Head using PSO Algorithm in WSNs
Dheyab Ibrahim (University of Babylon, Iraq); Saad Talib Hasson (University of Babylon & College of Information Technology, Iraq); Princy Johnson (Liverpool John Moores University, United Kingdom (Great Britain))

Thursday, September 22, 09:00 - 10:30 (KAKTUS)

S2: SIGNAL PROCESSING

Chair: Joško Radić (University of Split, Croatia)

Fast and Accurate Song Recognition: An Approach based on Multi-Index Hashing
Salvatore Serrano and Marco Scarpa (University of Messina, Italy)

Blind Channels Responses Estimation by Constrained Clustering
Michel Terré, Luc Féty and Thierry Horsin (CNAM, France)

All-to-All Personalized Communication on Fat-Trees Using Latin Squares
Daniele Izzi (University "La Sapienza", Italy); Annalisa Massini (Sapienza University of Rome, Italy)

Estimating the block-diagonal idiosyncratic covariance in high-dimensional factor models
Lucija Žignić (Department for Strategy and Operations, PricewaterhouseCoopers, Croatia); Stjepan Begušić and Zvonko Kostanjčar (University of Zagreb, Croatia)

Thursday, September 22, 11:00 - 12:30 (KAKTUS)

S3: 5G&B5G TECHNOLOGIES

Chair: Åke Arvidsson (Kristianstad University, Sweden)

Performance Evaluation for End-toEnd Slice Management in 5G/B5G Cellular Networks
Noor Abdalkarem Mohammedali and Triantafyllos Kanakis (University of Northampton, United Kingdom (Great Britain)); Ali Al-Sherbaz (The University of Gloucestershire & School of Computing and Engineering, United Kingdom (Great Britain)); Michael Opoku Agyeman (University of Northampton, United Kingdom (Great Britain))

NetApps Approach for Accelerating Vertical Adoption of 5G Networks: A UAV Case
Ignacio Martinez-Alpiste and Gelayol Golcarenarenji (University of the West of Scotland, United Kingdom (Great Britain)); Dimitrios Klonidis (UBITECH, Greece); Jose Maria Alcaraz Calero (University of the West of Scotland & School of Engineering and Computing, United Kingdom (Great Britain)); Qi Wang (University of the West of Scotland, United Kingdom (Great Britain))

Ethernet communication over IP transport for industrial and private cellular network
Vikramajeet Khatri (Nokia Bell Labs, Finland); Mehrnoosh Monshizadeh (Nokia Bell Labs, France); Kari Tiirikainen (Cloud Network Services, Nokia, Finland)

Experimental demonstration of hybrid photonics-based ARoF system for 5G and B5G networks
Armands Ostrovskis (Riga Technical University, Latvia); Toms Salgals (RTU, Latvia); Kristaps Rubuls (Riga Technical University, Latvia); Laura Skladova (RTU, Latvia); Vjaceslavs Bobrovs and Sandis Spolitis (Riga Technical University, Latvia)

Impact of Multi-Layer Recurrent Neural Networks in the Congestion Analysis of TeraHertz B5G/6G MAC Mechanism
Djamila Talbi and Zoltan Gal (University of Debrecen, Hungary)

Performance Assessments For SDN Control Plane Into Distinct Network Topologies
Pantelimon-Teodor Tivig (University Politehnica of Bucharest & Luxoft Romania, Romania); Eugen Borcoci (University Politehnica of Bucharest, Romania)

Distance Based Server Selection in 5G Networks
Åke Arvidsson (Kristianstad University, Sweden)

Friday, September 23, 09:00 - 10:30 (PALMA I)

S4: WIRELESS COMMUNICATIONS

Chair: Miljenko Mikuc (University of Zagreb, Croatia)

Design of Pattern-Reconfigurable SixElements Dipole Array for 5G Compact Base Station
Saber Dakhli (IETR Laboratory, INSA Rennes & Innov'Com Laboratory, SUPCOM, University of Carthage Tunis, France); Mohamed Khammeri (Land Army Ministry of Defense, Tunisia); JeanMarie Floc'h (INSA of Rennes, France); Feten Slimeni (Tunisia Polytechnic School, Tunisia)

A Comparative Study of Vegetation Attenuation at Millimeter Waves Bandwidth
Maciej Nikiforuk and Krzysztof Cichoń (Poznan University of Technology, Poland)

Indoor Positioning: Comparing Different Techniques and Choosing the Best One for a User Authentication Real Scenario
Joaquín Perez Balbela (Universidad Internacional de La Rioja - UNIR, Spain); Aruna Prem Bianzino (Funditec, Spain)

Determining the ABEP under the Influence of K-μ Fading and CCI with SC combining at L-branch Receiver Using Moment Generating Function
Dragana Krstić (University of Niš, Serbia); Suad Suljovic (Academy of Technical Professional Studies Belgrade, Serbia); Nenad Petrovic (University of Nis, Faculty of Electronic Engineering, Serbia); Sinisa Minić (Teachers College in Prizren - Leposavic, Serbia); Zoran Popovic (Technical College of Vocational Studies, Zvecan, Serbia)

Analytical Traffic Model for a Multidomain IMS/NGN Network Including Service and Transport Stratum
Sylwester Kaczmarek (Gdansk University of Technology & Faculty ETI, Poland); Maciej Sac (Gdansk University of Technology, Poland); Michał Cieśliński (Comarch S.A., Poland)

Friday, September 23, 14:30 – 16:00 (KAKTUS)

S5: OPTICAL COMMUNICATIONS

Chair: Stanislaw Kozdrowski (Warsaw University of Technology & Computer Science Institute, Poland)

IEEE 802.1X Virtual Network Function Development for NG-PON Architecture
Igor Araújo and Solange Rito Lima (Centro Algoritmi, University of Minho, Portugal); Andre Brizido (Altice Labs, Portugal)

Network Sanity Checks Through Graphs
Gian Paolo Jesi and Andrea Odorizzi (Lepida ScpA, Italy); Gianluca Mazzini (LepidaSpA & UniFe, Italy)

Networking Analysis of Photonics Integrated Multiband WSS Based ROADM Architecture
Muhammad Umar Masood, Ihtesham Khan, Lorenzo Tunesi, Bruno Correia and Rasoul Sadeghi (Politecnico di Torino, Italy); Enrico Ghillino (Synopsys, Inc, USA); Paolo Bardella, Andrea Carena and Vittorio Curri (Politecnico di Torino, Italy)

QoS Resource Reservation Mechanisms for Switched Optical Networks
Sylwester Kaczmarek (Gdansk University of Technology & Faculty ETI, Poland); Magdalena Młynarczuk (Gdańsk University of Technology & Faculty ETI, Poland); Arkadiusz Dumin (ADVA Optical Networking, Poland)

Adaptive Weights-based Dynamic Resource Provisioning in Space Division Multiplexed-Elastic Optical Networks (SDM-EONs)
Anjali Sharma and Baljinder Singh Heera (Indian Institute of Technology Kanpur, India); Varsha Lohani (IIT Kanpur, India); Yatindra Nath Singh (Indian Institute of Technology Kanpur, India)

Thursday, September 22, 11:00 - 12:30 (PALMA I)

S6: SOFTWARE AND SYSTEMS ENGINEERING

Chair: Linda Vicković (University of Split, Croatia)

Design and Implementation of a Software Vulnerabilities and Application Research Tool
Elisa Benetti (LepidaScpA, Italy); Andrea Zucchelli (Lepida ScpA, Italy); Gianluca Mazzini (LepidaSpA & UniFe, Italy)

Performance comparison of technological solutions for Spark applications in AWS
Riccardo Lancellotti and Stefano Rossi (University of Modena and Reggio Emilia, Italy); Giuseppe Calogero Miano and Fabio Miselli (Doxee, Italy)

Empirically Derived Use Cases for Software Analytics
Thiago Rique, Emanuel Dantas and Mirko Perkusich (VIRTUS, Brazil); Kyller Costa Gorgônio, Hyggo Almeida and Angelo Perkusich (Federal University of Campina Grande, Brazil)

Microservice performance in Container- and Function-as-a-Service architectures
Claudia Canali, Riccardo Lancellotti and Pietro Pedroni (University of Modena and Reggio Emilia, Italy)

Empirical Assessment on Interactive Detection of Code Smells
Danyllo Wagner Albuquerque (UFCG & Intelligent Software Engineering Group, Brazil); Everton Guimaraes (Penn State University, USA); Mirko Perkusich (VIRTUS, Brazil); Hyggo Almeida and Angelo Perkusich (Federal University of Campina Grande, Brazil)

Autonomy for Ships: System Thinking and Engineering
Kjeld Dittmann (Technical University of Denmark (DTU), Denmark)

Thursday, September 22, 09:00 - 10:30 (OLEANDAR)

S7: VEHICULAR COMMUNICATIONS

Chair: Ante Kristić (University of Split, Croatia)

The Solution for Creating a 2D TopView Map of the Pedestrian Positions Around the Vehicle
Nemanja Avramović (TTTech Auto CEE, Croatia); Mario Vranjes (University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Croatia); Željko Lukač (University of Novi Sad, Croatia); Jelena Kovacevic (University of Novi Sad, Serbia)

Vehicle Distance Estimation Based on Stereo Camera System with Implementation on a Real ADAS Board
Marko Miljković (TTTech Auto CEE, Croatia); Mario Vranjes (University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Croatia); David Mijić (TTTech Auto CEE, Croatia); Miodrag Đukić (University of Novi Sad, Serbia)

SWAP: Secure Warning Messages Authentication and Propagation in Internet of Vehicles
Alessandro Brighente, Mauro Conti and Harsha Vasudev (University of Padova, Italy)

Sector-Beam Antenna Array for 77 GHz Automotive RADAR Systems
Saber Dakhli (IETR Laboratory, INSA Rennes & Innov'Com Laboratory, SUPCOM, University of Carthage Tunis, France); Sourour Abdellaoui (Land Army, Ministry of Defense, France); Jean-Marie Floc'h (INSA of Rennes, France); Mimoun Hamdi (Land Army Ministry of Defense, Tunisia)

Design and evaluation of a cross-layer MPTCP path manager for vehicular networks
Vadym Hapanchak (University of Minho, Portugal); Antonio D. Costa (Universidade do Minho & Centro ALGORITMI, Portugal)

User Experience and Multimodal Usability of Navigation Systems – Evaluation of Effectiveness and Efficiency
Lumbardha Hasimi and Aneta Poniszewska-Maranda (Lodz University of Technology, Poland)

Thursday, September 22, 14:30 - 16:00 (KAKTUS)

S8: IOT SYSTEMS AND SERVICES

Chair: Giovanni Giambene (University of Siena, Italy)

LoRa-based System for IoT Applications via HAPS in Remote Areas
Giovanni Giambene (University of Siena, Italy); Karthik Korre (CNIT - University of Siena, Italy)

Cloud-based Spectrum Access Control System for Dense IoT Networks
Cezary Adamczyk, Adam Samorzewski, Mateusz Grzyb and Adrian Kliks (Poznan University of Technology, Poland)

Twin Delayed DDPG based Dynamic Power Allocation for Intenet of Robotic Things
Homayun Kabir (Universiti Tunku Abdul Rahman & Chittagong University of Engineering and Technology, Malaysia); Tham Mau Luen (UTAR, Malaysia); Yoong Choon Chang (Universiti Tunku Abdul Rahman, Malaysia)

Review of Recent Intrusion Detection Systems and Intrusion Prevention Systems in IoT Networks
Zouhair Chiba (FSAC, Hassan II University of Casablanca, Morocco); Noreddine Abghour, Khalid Moussaid and Oumaima Lifandali (FSAC, Hassan II University of Casablanca); Rachid Kinta (FSAC, Hassan II University of Casablanca, Morocco)

An Assessment Platform of Cybersecurity Attacks against the MQTT Protocol using SIEM
Mohamed Hadded (IRT SYSTEMX, France); Gaspard Lauras, Jerome Letailleur, Yohann Petiot and Anouk Dubois (IRT SystemX, France)

Securing IoT services based on security requirement categories
Karlo Slovenec (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia); Marin Vukovic (University of Zagreb Faculty of Electrical Engineering and Computing, Croatia); Denis Salopek (University of Zagreb, Croatia); Miljenko Mikuc (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia)

Thursday, September 22, 14:30 - 16:00 (PALMA I)

S9: NATURAL LANGUAGE PROCESSING

Chair: Marin Vukovic (University of Zagreb, Croatia)

Analysis of the Textual Information Extracted from News Portals
Linda Vickovic, Petra Lovrić and Hrvoje Karna (University of Split, Croatia)

A Hybrid Deep Learning Technique for Sentiment Analysis in E-Learning Platform with Natural Language Processing
Jay Krishna and Anupam Das (Royal Global University, India); Joanna Rosak-Szyrocka (Czestochowa University of Technology, India)

Employing a Seq2Seq Model for Spelling Correction in Albanian Language
Evis Trandafili, Alba Haveriku and Anea Bendo Polytechnic University of Tirana, Albania)

Data Structures Analysis for Text Processing in the Framework of NLP Classification in Polish
Urszula Krzeszewska and Aneta Poniszewska-Maranda (Lodz University of Technology, Poland)

Friday, September 23, 16:30 - 18:00 (HALL NEARBY OLEANDAR)

PAS1: POSTERS / ABSTRACTS SESSION

Chair: Marina Prvan (University of Split, Croatia)

Radio Environment Map and Deep QLearning for 5G Dynamic Point Blanking
Marcin Dominik Hoffmann and Pawel Kryszkiewicz (Poznan University of Technology, Poland)

Use of Facial Expressions to Improve the Social Acceptance of Level 4 and 5 Automated Driving System Equipped Vehicles
Antonio C Marceddu, Jacopo Sini, Bartolomeo Montrucchio and Massimo Violante (Politecnico di Torino, Italy)

Performance analysis for next generation CD and CDC based technology optical networks
Stanislaw Kozdrowski (Warsaw University of Technology & Computer Science Institute, Poland); Maria Konieczka and Alicja Poturala (Warsaw University of Technology, Poland); Sławomir Sujecki (Wroclaw University of Science and Technology, Poland)

Machine Learning Application to Transmission Quality Assessment in Optical Networks
Stanislaw Kozdrowski (Warsaw University of Technology & Computer Science Institute, Poland); Pawel Cichosz (Warsaw University of Technology, Poland); Sławomir Sujecki (Wroclaw University of Science and Technology, Poland)

Quality of Service Evaluation over a 496 km Quantum Key Distribution Network
Miryeong Park (KT corp. & Institute of Convergence Technology, Korea (South)); Kyungwoon Lee, Kanghee Seol and Minsoo Lee (KT corp., Korea (South)); HyungSoo Kim (Korea Telecom, Korea (South))

AI Application in Next Generation Programmable Networks
Mateusz Rasmus (Orange Labs Polska, Poland); Stanislaw Kozdrowski (Warsaw University of Technology & Computer Science Institute, Poland); Zbigniew Kopertowski (Orange Polska, Poland

SPECIAL SESSIONS AND SYMPOSIA

SS1: SPECIAL SESSION ON QoS IN WIRED AND WIRELESS NETWORKS

Friday, September 23, 09:00 - 10:30 (OLEANDAR)

SS1: Special Session on QoS in Wired and Wireless Networks

Chair: Pascal Lorenz (University of Haute Alsace, France)

Subjective Assessment of the Quality of Video Sequences by the Young Viewers
Stefan Brachmanski and Janusz Henryk Klink (Wroclaw University of Science and Technology, Poland)

Determination of Video Service Quality in an IP Environment with the Use of Different Software Tools: A Comparison Study
Tadeus Uhl (Maritime University of Szczecin/Poland, Poland); Christian Hoppe (Nextragen Solutions GmbH, Germany); Janusz Henryk Klink (Wroclaw University of Science and Technology, Poland)

Method of 5G TDD midhaul multiplexing gain estimation based on system-level traffic measurements
Dominik Dulas (Nokia Siemens Networks & Wroclaw University of Science and Technology, Poland); Katarzyna Maraj Zygmat and Krzysztof Walkowiak (Wroclaw University of Science and Technology, Poland)

Adaptive Multi-Connectivity Activation for Throughput Enhancement in 5G and Beyond Non-Terrestrial Networks
Mikko Majamaa (Magister Solutions Ltd, Finland); Henrik M J Martikainen (Magister Solutions Ltd. & Nokia, Finland); Lauri Sormunen (Magister Solutions Ltd, Finland); Jani Puttonen (Magister Solutions Ltd., Finland)

On Queueing Models for the Performance Analysis of a Vehicular Ad Hoc Network
Irene Lidia Keramidi (University of Peloponnese, Greece); Dimitrios Uzunidis (University of West Attica, Greece); Ioannis Moscholios (University of Peloponnese, Greece); Panagiotis Sarigiannidis (University of Western Macedonia, Greece); Michael D. Logothetis (University of Patras, Greece)

An impact of the encoding bitrate on the quality of streamed video presented on screens of different resolutions
Janusz Henryk Klink and Stefan Brachmanski (Wrocław University of Science and Technology, Poland)

SS2: SPECIAL SESSION ON AD HOC&SENSOR NETWORKS AND INTERNET OF THINGS

Friday, September 23, 09:00 - 10:30 (KAKTUS)

SS2: Special Session on Ad Hoc&Sensor Networks and Internet of Things

Chair: Petar Solic (University of Split, Croatia)

Performance of a wireless OCDMA network for baby bed monitoring in a nursery context
Amina Boussebt (University of Limoges & XLIM CNRS 7252, France); Stéphanie Sahuguède (XLIM UMR CNRS 7252 - University of Limoges, France); Anne Julien-Vergonjanne (University of Limoges & XLIM CNRS 7252, France); Sébastien Reynaud (High Frequency Systems Department, France & CISTEME, France)

Detection of Tennis Strokes using Wearable Sensor
Omar Hazem and Ahmed Farouk (October University for Modern Sciences and Arts (MSA), Egypt)

Cost Effective Smart Parking System on Campus
Andrew Jung, Daniel Baqaeen, Rachel Liang and Magdalene Piotrowski (University of Hartford, USA)

LogStack: A smart Logging Stack Approach for IoT devices based NDN (IoT-NDN)
Mohamed Ahmed Mohamed Hail, Leon Christopher Dietrich and Stefan Fischer (University of Lübeck, Germany)

SS3: SPECIAL SESSION ON SECURITY AND DIGITAL FORENSICS

Friday, September 23, 14:30 - 16:00 (OLEANDAR)

SS3: Special Session on Security and Digital Forensics

Chair: Toni Perković (University of Split, Croatia)

An efficient Federated Identity Management Protocol for Heterogeneous Fog computing Architecture
Imine Youcef (Univ Polytechnique HautsDe-France LAMIH CNRS, France); Antoine Gallais (Univ Polytechnique Hauts-DeFrance LAMIH CNRS & INSA Hauts-DeFrance, France); Yacine Challal (University of Doha for Science and Technology & Heudiasyc lab. UMR CNRS, Qatar)

Telecom Fraud Detection with Machine Learning on Imbalanced Dataset
Ivan Krasić (Trg Žrtava Domovinskog Rata 9, Bosnia and Herzegovina); Stipe Celar (University of Split & FESB, Croatia)

Base systems for Docker containers - security analysis
Arkadiusz Maruszczak, Michał Walkowski and Sławomir Sujecki (Wroclaw University of Science and Technology, Poland)

Predicting vulnerabilities in web applications based on website security model
Ivan Kovačević, Mihael Marović and Stjepan Gros (University of Zagreb, Croatia); Marin Vukovic (University of Zagreb Faculty of Electrical Engineering and Computing, Croatia)

Blockchain Redaction in Self-Sovereign Identity
Šeila Bećirović (University of Sarajevo, Bosnia and Herzegovina); Špela Čučko (University of Maribor, Slovenia); Muhamed Turkanović (University of Maribor, Faculty of Electrical Engineering and Computer Science, Slovenia); Haris Supic and Sasa Mrdovic (University of Sarajevo, Bosnia and Herzegovina)

Let's Read: Analysing S/MIME certificate vendors' Efficiency and Privacy
Tobias Mueller (Uni Hamburg, Germany); Max E. Hartenstein (Universität Hamburg, Germany)

Long-term Parameters Monitoring of the IDQ Clavis 3 QKD System
Ondrej Klicnik, Adrian Tomasov, Petr Munster, Tomas Horvath and Jan Hajný (Brno University of Technology, Czech Republic)

SS4: SPECIAL SESSION GREEN NETWORKING AND COMPUTING

Thursday, September 22, 09:00 – 10:30 (PALMA I)

SS4: Special Session on Green Networking and Computing

Chair: Josip Lorincz (University of Split, Croatia)

Energy Efficient and Context-aware Trajectory Planning for Mobile Data Collection in IoT using Deep Reinforcement Learning
Sana Benhamaid (University of Technology of Compiegne & Heudiasyc Laboratory, France); Hicham Lakhlef (Université de Technologie de Compiègne, France); Abdelmadjid Bouabdallah (Universite de Technologie - Compiegne, France)

An Approach based on vSDN to Optimize Power Consumption
Euclides Neto (University of New Brunswick, Canada); Gustavo Callou (Federal Rural University of Pernambuco & UFRPE, Brazil)

Cooling power dependency simulation for real-world data center data
Jana Backhus (Hitachi America Ltd., USA); Yasutaka Kono (Hitachi Ltd., Japan)

PWU: Pre-Wakeup for CPU Idle to Reduce Latency and Power Consumption
Kei Fujimoto, Hikaru Harasawa and Ko Natori (NTT Corporation, Japan); Ikuo Otani (NTT, Japan); Shogo Saito and Akinori Shiraga (NTT Corporation, Japan)

TIMETABLE A: TECHNICAL PROGRAM, SYMPOSIA

Thursday, September 22 (hybrid: Hotel Radisson Blu Split and virtual)			
Time/Hall	**OLEANDAR**	**KAKTUS**	**PALMA I**
08:00-09:00	**REGISTRATION**		
09:00–10:30	S7: Vehicular Communications	S2: Signal Processing	SS4: Special Session on Green Networking and Computing
10:30–11:00	**Coffee Break**		
11:00–12:30	S1/II: Machine Learning Applications II	S3: 5G & B5G Technologies	S6: Software and Systems Engineering
12:30–14:30	**Lunch**		
14:30-16:00	S1/I: Machine Learning Applications I	S8: IoT Systems and Services	S9: Natural Language Processing
16:00–16:30	**Coffee Break**		

Friday, September 23 (hybrid: Hotel Radisson Blu Split and virtual)			
Time/Hall	**OLEANDAR**	**KAKTUS**	**PALMA I**
08:00-09:00	**REGISTRATION**		
09:00–10:30	SS1: Special Session on QoS in Wired and Wireless Networks	SS2: Special Session on Ad Hoc&Sensor Networks and Internet of Things	S4: Wireless Communications
10:30–11:00	**Coffee Break**		
11:00–12:30	**Keynote Speeches:** **Elia Berteletti, Partner, McKinsey & Company** ***Yes!, Agile for hardware R&D really works* (GRAND BALLROOM)** **Ante Mihovilovic** ***5G networks, impact on the industry and cloud-native transformation* (GRAND BALLROOM)**		
12:30-14:30	**Conference Luncheon**		
14:30–16:00	SS3: Special Session on Security and Digital Forensics	S5: Optical Communications	SS6: Special Session on Robotics and ICT Assisted Wellbeing
16:00-16:30	**Coffee Break**		
16:30-18:00	SS5: Special Session on Environmental Electromagnetic Compatibility (EEMC)	SS7: Special Session on Advanced Educational Technologies	PAS1: Posters/Abstracts Session (hall nearby OLEANDAR) PDS1: Posters/Demos Session (hall nearby OLEANDAR)
18:00–	**Social program**		

Saturday, September 24 (hybrid: Hotel Radisson Blu Split and virtual)			
Time/Hall	**OLEANDAR**	**KAKTUS**	**PALMA I**
09:00–10:30	Business forum events		
10:30–11:00	**Coffee Break**		
11:00–	**Conference trip**		

TIMETABLE B: WORKSHOPS, TUTORIALS, BUSINESS FORUM

Thursday, September 22 (hybrid: Hotel Radisson Blu Split and virtual)		
Time/Hall	**AGAVA**	**PALMA II**
08:00-09:00	**REGISTRATION**	
09:00–10:30	Workshop on Joint Master Thesis Topics in ICT (AGAVA)	
10:30–11:00	**Coffee Break**	
11:00–12:30	SYM1: Symposium on Information Security and Intellectual Property (ISIP) (PALMA II) Invited talk: Mirjana Pejić Bach	
12:30–14:30	**Lunch**	
14:30-16:00	Business forum events	
16:00–16:30	**Coffee Break**	

Friday, September 23 (hybrid: Hotel Radisson Blu Split and virtual)		
Time/Hall	**AGAVA**	**PALMA II**
08:00-09:00	**REGISTRATION**	
09:00-10:30	WESC: Ericsson Nikola Tesla Summer Camp 2022 Workshop	Tutorial T3 (Z. Blažević) *Historical and theoretical aspects of resonant near-field radio power transfer-ways from basics to maximum performances*
10:30-11:00	**Coffee Break**	
11:00-12:30	**Keynote Speech:** **Elia Berteletti, Partner, McKinsey & Company** **Yes!, Agile for hardware R&D really works (GRAND BALLROOM)**	
12:30-14:30	**Conference Luncheon**	
14:30-16:00	PHD FORUM	Tutorial T2 (M. Zhadobov) *Physical foundations of frequency-dependent bioelectromagnetic interactions*
16:00-16:30	**Coffee Break**	
16:30-18:00	11th Workshop on Software Engineering in Practice (WSEP)	Workshop on Process Compliance and Control
18:00-	**Social program**	

Saturday, September 24 (hybrid: Hotel Radisson Blu Split and virtual)		
Time/Hall	**AGAVA**	**PALMA II**
09:00–10:30	WICT: Workshop on ICT	Tutorial T1 (D. Poljak and M. Cvetković) *Human Exposure to Non-ionizing Radiation*
10:30–11:00	**Coffee Break**	
11:00–	**Conference trip**	

SS5: SPECIAL SESSION ON ENVIRONMENTAL ELECTROMAGNETIC COMPATIBILITY (EEMC)

Friday, September 23, 16:30-18:00 (OLEANDAR)

SS5: Special Session on Environmental Electromagnetic Compatibility (EEMC)

Chair: Dragan Poljak (University of Split, Croatia)

Analysis of SAR in a Simplified Body Model due to a Short Dipole Antenna Radiation
Anna Šušnjara (University of Split & FESB, Croatia); Dragan Poljak and Ivan Matić (University of Split, FESB, Croatia)

Septum Feed Design for Right and Left Circular Polarisation
Maja Škiljo and Zoran Blažević (University of Split, Croatia); Dragan Poljak (University of Split, FESB, Croatia)

Stochastic-Deterministic Electromagnetic Modeling of Human Head Exposure to Microsoft HoloLens
Ante Lojić Kapetanović (University of Split, Croatia); Anna Šušnjara (University of Split & FESB, Croatia); Dragan Poljak and Mladen Russo (University of Split, Croatia)

On 5G Radiated Field Measurement/Calculation Procedures and Exposure Compliance Limits
Marin Galić (Centar za Mjerenja u Okolisu, Croatia); Miroslav Crnolatec (Environmental Measurement Center, Croatia); Dragan Poljak (University of Split, Croatia)

Review of Least Action Principle in Electromagnetics Part I: Derivation of Continuity Equation and Lorentz Force
Dragan Poljak (University of Split, Croatia)

Review of Least Action Principle in Electromagnetics Part II: Derivation of Maxwell's Equations
Dragan Poljak (University of Split, Croatia)

Review of Least Action Principle in Electromagnetics Part III: Applications
Dragan Poljak (University of Split, Croatia)

SS6: SPECIAL SESSION ON ROBOTICS AND ICT ASSISTED WELLBEING

Friday, September 23, 14:30 - 16:00 (PALMA I)

SS6: Special Session on Robotics and ICT Assisted Wellbeing

Chair: Vladan Papić (University of Split, Croatia)

Topology optimization of an assembled 3D printed robot
Ivan Chavdarov (Institut of Robitics, Bulgarian Academy of Sciences & Sofia University "St. Kliment Ohridski", FMI, Bulgaria); Bozhidar Naydenov (Dassault Systemes & Institut of Robitics, Bulgarian Academy of Sciences, Bulgaria); Kaloyan M Yovchev and Lyubomira Miteva (Sofia University, Bulgaria)

Behavior Exploration of Humanoid Robot NAO and Comparative Interaction Study of Autistic Children with the Robot and Human
Mirajul Mohin, Sourav Deb and Saifuddin Md. Tareeq (University of Dhaka, Bangladesh)

Neural Network-based End-effector Force Estimation for Mobile Manipulator on Simulated Uneven Surfaces
Stanko Kruzic, Josip Music, Ivo Stancic and Vladan Papic (University of Split, Croatia)

Variable Selection for the Prediction of TSS, pH and TA of Intact Berries of Thompson Seedless Grapes from their NIS Reflection
Chrysanthi Chariskou (International Hellenic University, Greece); Christos Bazinas (International Hellenic University (IHU), Greece); Andries Daniels (University of Stellenbosch, South Africa); Umezuruike Opara Stellenbosch University, South Africa); Hélène Nieuwoudt (University of Stellenbosch, South Africa); Vassilis G. Kaburlasos (International Hellenic University (IHU) & HUman-MAchines INteraction (HUMAIN) Lab, Greece)

Augmented reality based sensor data visualization for plant growth monitoring
Ela Drutter (Croatia); Mario Miličević (University of Split, Croatia); Ana Kuzmanić Skelin (Faculty of Electrical Engineering, Croatia); Mirjana Bonkovic (University of Split, Croatia)

SS7: SPECIAL SESSION ON ADVANCED EDUCATIONAL TECHNOLOGIES

Friday, September 23, 16:30 - 18:00 (KAKTUS)

SS7: Special Session on Advanced Educational Technologies

Chair: Ani Grubišić (University of Split, Croatia)

Predicting Students' Final Exam Grades Based on Learning Material Usage extracted from Moodle Logs
Suzana Marija Dunatov, Kristian Kasalo, Anamaria Lovrinčević, Jelena Maljković and Antonela Prnjak (University of Split, Croatia)

Using Moodle Test Scores to Predict Success in an Online Course
Dorotea Bertović, Marina Mravak, Kristina Nikolov and Nikolina Vidović (University of Split, Croatia)

Teaching & Learning Analytics for Data-Based Optimization of Teaching and Learning Processes in Courses with Blended Learning
Birgit Pohn (University of Applied Sciences Technikum Wien); Lars Mehnen (Technikum Wien, Austria); Matthias Blaickner and Isabel Dregely (University of Applied Sciences Technikum Wien, Austria); Thomas Mandl (FH Technikum Wien, Austria)

VR Training for Laboratory Environments
Birgit Pohn (University of Applied Sciences Technikum Wien); Josef Wermann (University of Applied Sciences Technikum Wien, Austria)

Application of e-learning in theoretical part of the subject Informatics
Boško Lišnić (University of Split, Croatia); Saša Mladenović (University of Split & Faculty of Science, Croatia); Ani Grubisic (University of Split, Croatia)

Modelling assessment rubrics through Bayesian networks: a pragmatic approach
Francesca Mangili (DTI, SUPSI & IDSIA - USI, SUPSI, Switzerland); Giorgia Adorni (IDSIA & USI - SUPSI, Switzerland); Alberto Piatti (SUPSI DFA, Switzerland); Claudio Bonesana and Alessandro Antonucci (IDSIA SUPSI, Switzerland)

Predicting programming success: How intermittent knowledge assessments, individual psychometrics, and restingstate EEG predict Python programming and debugging skills
Chu-Hsuan Kuo, Malayka Mottarella, Theodros Haile and Chantel Prat (University of Washington, USA)

PROFESSIONAL PROGRAM

Saturday, September 24, 09:00 - 10:30 (AGAVA)

WICT: Workshop on Information and Communication Technologies

Chair: Duje Čoko (University of Split, Croatia)

Blending Open Source Tools for Rapid Development of Web Data Entry Interfaces
Gian Paolo Jesi and Paolo Ravelli (Lepida ScpA, Italy); Gianluca Mazzini (LepidaSpA & UniFe, Italy)

Integrating google sheets into business processes: an innovative approach
Stefania Nanni (Lepida ScpA, Italy); Gianluca Mazzini (LepidaSpA & UniFe, Italy)

Public Attribute System: a novel way to user profiling
Stefania Nanni (Lepida ScpA, Italy); Gianluca Mazzini (University of Ferrara and LepidaSpA, Italy); Massimo Carboni (Lepida Scpa, Italy)

Fault diagnostics of a maritime diesel engine using Fast Fourier Transform
Ante Rubic and Joško Radić (University of Split, Croatia)

Friday, September 23, 16:30 - 18:00 (HALL NEARBY OLEANDAR)

PDS1: Posters/Demos Session

Chair: Marina Prvan (University of Split, Croatia)

Measurement of Shielding Effectiveness (SE) of Conductive Textile Materials on 5G Frequencies
Krešimir Malarić (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia); Bosiljka Saravanja (Universty of Zagreb, Faculty of Textile Technology, Croatia); Tanja Pušić (University of Zagreb, Faculty of Textile Technology, Croatia)

UAV Reconnaissance in Search and Rescue Missions: Towards Ethically Sound Human-Computer Interaction and System Design
Philip Taupe, Tatjana Ceranic and Michael Hofstätter (AIT Austrian Institute of Technology GmbH, Austria); Georg Aumayr and Birgit Schilcher (Johanniter Österreich Ausbildung und Forschung gem. GmbH, Austria); Martina Philippi (Ruhr-Universität Bochum, Germany); Astrid Raschig and René Kastner (Disaster Competence Network Austria, Austria)

Novel Interactive BRAINTEASER Tools for Amyotrophic Lateral Sclerosis (ALS) and Multiple Sclerosis (MS) Management
Vladimir D. Urošević and Nikola Vojičić (Belit Ltd. Belgrade, Serbia); Sergio Gonzalez-Martinez (Universidad Politecnica de Madrid, Spain); Ognjen Milićević (Belit Ltd. Belgrade, Serbia); Maria Fernanda Cabrera-Umpierrez (Life Supporting Technologies; Technical University of Madrid, Spain)

Thursday, September 22, 11:00 - 12:30 (PALMA II)

SYM1: SYMPOSIUM ON INFORMATION SECURITY AND INTELLECTUAL PROPERTY (ISIP)

ISIP INVITED TALK: MIRJANA PEJIĆ BACH

TARGETS OF PHISHING ATTACKS: THE BIGGER FISH TO FRY

Mirjana Pejić Bach, PhD

Faculty of Economics & Business, University of Zagreb, Croatia

Summary:
Phishing attacks are one of the most common forms of information security threats. Previous research indicates that users with higher educational levels are less susceptible to phishing attacks. The paper's goal is to investigate the occurrence of phishing attacks in European countries, considering the educational level of individuals. Fuzzy clustering has been used for grouping European countries according to the educational level of individuals and the occurrence of phishing attacks. Contrary to the rationale that more educated users are less susceptible to internet fraud, the results indicate that these individuals are more susceptible to phishing attacks.

Biography:

Mirjana Pejić Bach is a full professor at the Department of Informatics, Faculty of Economics in Zagreb. She holds a PhD in system dynamics modelling from the Faculty of Economics, University of Zagreb. She was trained at the MIT Sloan School of Management in system dynamics and OliviaGroup in data mining. Mirjana is the leader and collaborator of numerous projects in which she cooperates with Croatian companies and international organizations, mainly through European Union projects and the bilateral research framework. Her research areas are the strategic application of information technology in business, data science, simulation modelling, research methodology, qualitative and quantitative, especially multivariate statistics and modelling structural equations. Mirjana is the editor of several scientific journals indexed in the Scopus and WoS and has organized several conferences and given plenary lectures at congresses, such as IEEE Systems. She has won several international awards for her scientific work, such as the Emerald Literati Network Awards for Excellence. According to the Scopus scientific database, Mirjana Pejić Bach is among the 2% of the most cited scientists in 2020. She received the largest number of citations from the field of Artificial Intelligence & Image Processing, in which she is among the 1.35% of scientists with the greatest impact of citations. The main goal of her work is to support aspiring researchers through mentoring doctoral theses and the development of their scientific careers.

SYM1: Symposium on Information Security and Intellectual Property (ISIP)
Co-Chairs: Marija Boban (University of Split, Croatia) and Gordan Ježić (University of Zagreb, Croatia)

Protection of Vulnerable Persons on Internet
Ivan Vukušić (University of Split Faculty of Law, Croatia)

„Smart City" Concept as Possible Tool for Local Government Modernization
Mirko Klaric (University of Split, Croatia)

Basic Elements of Informed Consent
Dinka Šago (University of Split & Faculty of law, Croatia)

Protection of Undisclosed Know-How and Trade Secrets Against Their Unlawful Acquisition, Use and Disclosure in Digital Age
Marija Boban (University of Split & Faculty of law, Croatia)

Digital Content and Criminal Responsibility - Attitudes and Understandings of Students
Ivana Stipanovic (University of Mostar & Faculty of Law, Bosnia and Herzegovina); Mirela Mabić (University of Mostar, Bosnia and Herzegovina)

Friday, September 23, 14:30-16:00 (AGAVA)

PHD FORUM

The PhD Forum provides an opportunity for doctoral students to present their work related to the SoftCOM 2022 conference topics to a wider community of researchers from academia and industry. The forum aims to encourage interaction and networking among doctoral students, as well as with the audience.
The PhD Forum has been organized as a poster session, preceded by a fast-paced introduction by each student that offers a preview of the posters. Each student has a strictly-timed 2-minutes' slot to present a "pitch talk" about her/his research. The purpose of the pitch talk is to provide a brief outline of one's doctoral research work, with the goal to raise awareness and generate further discussion over the poster session and coffee break that follow.

Steering committee:

Maja Matijašević, University of Zagreb
Dinko Begušić, University of Split
Tihana Galinac Grbac, Juraj Dobrila University of Pula
Darko Huljenić, Ericsson Nikola Tesla
Drago Žagar, Josip Juraj Strossmayer University of Osijek

Program & Organizing Committee:

Maja Škiljo, University of Split, Chair
Andrej Grgurić, Ericsson Nikola Tesla
Petar Krivić, University of Zagreb
Višnja Križanović, Josip Juraj Strossmayer University of Osijek
Goran Mauša, University of Rijeka
Reinhard Teschl, Graz University of Technology

Anomaly Detection in Hybrid SDN Network with Supervised Machine Learning Algorithms
Igor Fosić (HEP-Telekomunikacije, Croatia); Drago Zagar (Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, Croatia)

Use of Supervised Machine Learning Techniques to Counter the Coronavirus Advancement
Antonio C Marceddu and Bartolomeo Montrucchio (Politecnico di Torino, Italy)

Multi-Agent System for Service Provisioning in an Internet of Things Smart Space based on User Preferences
Katarina Mandarić (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia); Gordan Jezic (University of Zagreb, Croatia)

LoRa overview and evaluation
Ana Pejkovic (Josipa Kozarca 51, Croatia); Kresimir Grgic (J. J. Strossmayer University of Osijek, Croatia); Drago Zagar (Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, Croatia)

A novel IoT sensor for real-time crop monitoring of chlorophyll fluorescence
Josip Spišić (FERIT Osijek, Croatia); Drago Zagar (Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, Croatia); Jelena Šuljug (J. J. Strossmayer University of Osijek, Croatia)

Supervisory Control and Data Acquisition (SCADA) Systems in Continuous Manufacturing Process Control
Mladen Sverko (University of Zagreb & Danieli Systec, Croatia); Tihana Galinac Grbac (Juraj Dobrila University of Pula & Faculty of Engineering, Croatia); Miljenko Mikuc (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia)

Increasing the accuracy of geotagging from unstructured text
Selena Knežić Buhovac (University of Mostar & University of Split, Bosnia and Herzegovina); Ljiljana Šerić (University of Split - Faculty of El. Eng., Mech. Eng. and Naval Arch., Croatia); Antonia Ivanda (University of Split - Faculty of El. Eng., Mech. Eng. and Naval Arch. Croatia, Croatia)

Adaptive Data-Driven Edge-to-Cloud Environment
Ivan Čilić (University of Zagreb Faculty of EE and Computing, Croatia); Ivana Podnar Zarko (University of Zagreb, Croatia)

Overview and comparison of different techniques for reducing the amount of data transferred in IoT
Dora Kreković (University of Zagreb, Croatia)

TUTORIALS

TUTORIAL T1

Saturday, September 24 09:00-10:30 (PALMA II)

Dragan Poljak and Mario Cvetković, PhD
University of Split, FESB Split, Croatia

Human Exposure to Non-ionizing Radiation

Abstract: This Tutorial is mainly based on the book, D. Poljak, M. Cvetkovic, Human Interaction with Electromagnetic Fields; Computational Models in Dosimetry, Elsevier 2019, on some recent journal papers and activities in IEEE ICES SC6 Working Group. Tutorial aims to cover several aspects of human exposure to electromagnetic fields (EMF) including not only the undesired exposure from artificial sources, but also the biomedical applications of electromagnetic fields. The tutorial outlines some basic aspects of electromagnetic fields in environment, coupling mechanisms between humans and electromagnetic fields, established biological effects of electromagnetic fields from static to high-frequency range, international safety guidelines related to limiting human exposure to those fields, including relevant exposure limits and safety guidelines, electromagnetic-thermal dosimetry models and the related analytical/numerical solution methods. Finally, some findings pertaining to activities carried out within the framework of IEEE ICES working groups, which Tutorial presenters participated (WG2, WG3, WG5 and WG7 in particular) will be addressed. First, theoretical/experimental methods of incident field dosimetry for the assessment of external fields due to low frequency (LF) and high frequency (HF) sources are given in detail. Illustrative examples include analysis of power lines, transformer substations, PLC systems, RFID antennas, Wireless Power Transfer (WPT) systems and radio base stations pertaining to 2G/3G/4G and 5G mobile communication systems. Then, the tutorial deals with some electromagnetic-thermal dosimetry methods for the assessment of human exposure to low frequency (LF), high frequency (HF) and transient electromagnetic radiation featuring the use of integral/differential equation formulations and related numerical solution procedures (primarily based on the use of Boundary Element Method – BEM, and Finite Element method – FEM) for the calculation of induced current densities, internal fields, specific absorption rate (SAR), incident power density (IPD), absorbed power density (APD), transmitted power density (TPD) and specific absorption (SA). Also, for HF exposures the related temperature increase in tissues is of interest. In particular, for GHz frequency range, as far as 5G systems are concerned, a surface temperature elevation on the air-body interface is considered. Computational examples pertaining to various realistic exposure scenarios, such as; pregnant woman/foetus exposed to low frequency (LF) fields, the human eye, the human brain and the human head exposed to HF electromagnetic fields will be given. In particular, for GHz frequency range, several tissue models, from rather simple to more realistic, will be discussed. Moreover, the applicability of numerical integration at frequencies related to 5G will be discussed in terms of both matrix fill time and memory allocation. The set of tests for various combinations of source and observation triangles using the developed unit cube test will be demonstrated. The results of the convergence tests performed to investigate the effects of the increasing frequency and the discretization scheme on the numerical solution will be demonstrated, as well as a solution on how to curb the computational requirements by the proficient use of numerical integration. The obtained numerical results for induced current densities, internal fields, SAR, IPD, APD TPD and SA are compared against exposure limits proposed by recently issued ICNIRP 2020 (International Commission on Non Ionizing Radiation Protection). This is followed by some examples of biomedical applications of electromagnetic fields, including the transcranial magnetic stimulation (TMS), transcranial electrical stimulation (TES), but also some electrotherapy and magnetotherapy techniques. Also, some illustrative computational examples pertaining to thermal modeling of certain ophthalmological procedures will be given. In the last part of the Tutorial the stochastic modeling of electromagnetic fields is discussed. Namely, the input parameters of models used in bioelectromagnetism and electromagnetic dosimetry suffer from inherent uncertainty. The values of body tissue parameters such as permittivity and the electrical conductivity differ appreciably, depending on the age and gender, but also between healthy and ill individuals. Moreover, they are obtained under different measurements on ex vivo animal and human tissues, and exhibit relatively significant variations from their averages. When used in a computational model, these average values sometimes result in a rough approximation of the realistic scenario. The models used in bioelectromagnetics and numerical dosimetry are computationally rather demanding as they represent tremendously complex physical phenomena. Despite the progress in high-performance calculation, uncertainty quantification (UQ) based on traditional Monte Carlo method is still an enormous burden regarding computational cost. Therefore, alternative methods such as generalized polynomial chaos and stochastic collocation have become of interest to many researchers in this research area. In this tutorial, an outline of the application of stochastic collocation (SC) together with some illustrative examples are given. Finally, a sensitivity analyis on the impact of individual input parameters will be presented. The Tutorial ends up by addressing some ongoing work pertaining to WG 7 activities regarding different averaging schemes and methods used in APD assessment.

Biography: *Dragan Poljak received his PhD in el. Eng. in 1996 from the Univ. of Split, Croatia. He is the Full Prof. at Dept. of Electron. and Computing, Univ. of Split. His research interests include computational electromagnetics (electromagnetic compatibility, bioelectromagnetics, ground penetrating radar and plasma physics). To date Prof. Poljak has published more than 160 journ. and 250 conf. papers, and authored some books, e.g. two by Wiley, New Jersey and one by Elsevier, St Louis. He is a Senior member of IEEE, a member of Editorial Board of Eng. Anal. with Boundary Elements, Math. Problems in Eng. And IET Sci. Measur. & Techn. He was awarded by several prizes for his research achievements, such as National Prize for Science (2004), Croatian sect. of IEEE annual Award (2016), Technical Achievement Award of the IEEE EMC Society (2019) and George Green Medal from University of Mississippi (2021). From May 2013 to June 2021 Prof. Poljak was a member of the board of the Croatian Science Foundation. He was involved in ITER physics EUROfusion collaboration and he is currently involved in DONES EUROfusion collaboration and in Croatian center for excellence in research for tech. sciences. He is active in few Working Groups of IEEE/Internat. Committee on Electromagnetic Safety (ICES) Tech. Comm. 95 SC6 EMF Dosimetry Modeling, (co-chair of WG2 and WG7).*

Biography: *Mario Cvetković received his BSc in electrical engineering from the University of Split, Croatia in 2005. In 2009 he obtained MPhil degree from the Wessex Institute of Technology, University of Wales, UK. In December 2013 he received PhD from University of Split, Croatia. He is assistant professor at the Faculty of electrical engineering, mechanical engineering and naval architecture (FESB), University of Split were he teaches fundamentals of electrical engineering course. He held a series of tutorials and seminars related to advanced topics in bioelectromagnetics and various aspects of interaction of humans with electromagnetic fields at the: Technical University of Ilmenau, Germany (2010), Malardalen University, Vasteras, Sweden (2014, 2018), Nagoya Institute of Technology, Nagoya, Japan (2017), University of Maribor, Slovenia (2018, 2019), several Splitech conferences (2016, 2017, 2018, 2019), and SoftCOM conferences (2019, 2021). He is a recipient of the "Best Student Paper Award", awarded at the 16th edition of the international conference SoftCOM 2008. At the Scientific Novices Seminar held in 2012, he was awarded with the recognition for his previous scientific achievements. To date he has published more than 70 journal and conference papers and several book chapters. In 2019 he coauthored with D. Poljak the book entitled "Human Interaction with Electromagnetic Fields – Computational Models in Dosimetry" published by Elsevier. He is a member of the IEEE/International Committee on Electromagnetic Safety (ICES) Technical Committee 95 SC6 EMF Dosimetry Modeling.*

TUTORIAL T2

Friday, September 23 14:30–16:00 (PALMA II)

Maxim Zhadobov, PhD

IETR/CNRS, France

Physical foundations of frequency-dependent bioelectromagnetic interactions

Abstract: This tutorial will provide an overview of fundamental aspects related to interactions of electromagnetic waves with the human body. In particular, it will deal with electromagnetic properties of biological tissues, frequency-dependent physical mechanism of interaction between electromagnetic waves and biological tissues, as well as numerical and experimental electromagnetic dosimetry and exposure assessment.

Biography: *Maxim Zhadobov received the Ph.D. degree from the IETR (Institut d'Electronique et des Technologies du numeRique), University of Rennes 1, France, in 2006. He was a Postdoctoral Researcher with the Center for Biomedical Physics, Temple University, Philadelphia, PA, USA, until 2008, and then joined the French National Center for Scientific Research (CNRS). He is currently Senior Research Scientist at the IETR/CNRS and head of the eWAVES research team, IETR. His scientific interests and research activities are in the field of innovative biomedical applications of electromagnetic fields and associated technologies. He coauthored 5 book chapters, more than 80 research papers in peer-reviewed international journals and 200 contributions to conferences and workshops. His review article in the Int. J. Microwave Wireless Techn. has been the most cited paper in 2016-2020. A paper published by his research group in 2019 is in Journal Top 100 of Nature Scientific Reports. He has been involved in 25 research projects (12 as PI). Dr. Zhadobov was the TPC co-chair of BioEM 2021 and BioEM 2020. He was a TPC member and / or session organizer at international conferences, including IEEE IMBioC 2022, AT-AP-RASC 2022, BioEM 2019, EuMW 2019, IEEE iWEM 2017, MobiHealth 2015-2017, BodyNets 2016, and IMWS-Bio 2014. He is an elected member of EBEA Council, member of IEEE TC95.4, and vice-president of URSI France Commission K. He is Associate Editor of IEEE Journal of Electromagnetics RF and Microwaves in Medicine and Biology and served as a guest editor of several special issues, including "Human Exposure in 5G and 6G Scenarios" of Applied Sciences. He is a member of the Technical Advisory Committee URSI Com-K and has been acting as an expert at research councils worldwide. He received CNRS Medal in 2018, EBEA Award for Excellence in Bioelectromagnetics in 2015, and Brittany's Young Scientist Award in 2010.*

TUTORIAL T3

Friday, September 23 9:00–10:30 (PALMA II)

Zoran Blažević, PhD

University of Split, Croatia

Historical and theoretical aspects of resonant near-field radio power transfer-ways from basics to maximum performances

Abstract: This tutorial is aimed to depict basic theoretical aspects of resonant wireless power transfer technology that becomes more and more interesting with development of Internet-of-Things and 5G/6G networks. It originates from very dawn of radio, as proposed by Nikola Tesla at the turnover of XIX/XX century. He showed by his New York Laboratory and Colorado Springs experiments that, apart from efficient communication capabilities, the radio-technology can be efficient for power transfer purposes as well. For that matter, he developed several propositions for radio power transfer techniques based on the application of electrically small antennas in resonance, which was finalized by his global "Word System" concept of wireless telegraphy, telephony, and electrical energy transfer. In perspective, an efficient solution to transmission of energy without wires for purposes charging existing myriad of electronic gadgets, smartphones, sensors, various electric vehicles, and other electric devices would enable the wireless communication by wirelessly charged devices, a concept thar can be called "true mobility". Actually, there exist various transmission techniques that can be applied depending on the requirements of energy transmission. Along these lines, there are several approaches to transmission of energy without wires, each could be attributed to the specific regions of the field that the antenna radiates. In all of them however, to achieve a high transfer efficiency, it is necessary to provide a system setup that minimizes the power loss due to the propagation of radio-waves and mismatch. Namely, the energy transmission can be executed in the far field of antenna, which assumes the usage of aligned electrically large antennas, each with high directivity to minimize the propagation loss. On the other hand, the original proposition of Tesla relays on resonant coupling of electrically small antennas in the near field, where the crucial matter is to set the power transfer system in resonance and in conditions of maximum power transfer performances. The latter is the main issue of this tutorial, as the technique is already shown to be feasible for efficient power transfer on small and medium distances. The tutorial begins with some important historical aspects that depicts the development of the near-field energy transfer concept tightly connected to the birth of radio and the development of the idea, which is followed by its theoretical basics. An important phenomenon of the system resonant frequency splitting is addressed. The most important issue of achieving an efficient power transfer at a distance is observed from the standpoint of the theory of antennas, based on spherical modes electromagnetic field decomposition. Several approaches to the maximum performances are presented and mutually compared: frequency tracking, odd/even mode tunning, critical coupling, and conjugate matching. We shall also see some practical schemes and discuss some specific problems and solutions developed by the antenna theory and show some illustrative examples of the phenomenon.

Biography: *Zoran Blažević was born in Split, Croatia, 1968. He received his BS degree in 1993, MS degree in 2000 and PhD in 2005 at the University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia. For six years he was with Croatian Railways as a telecommunication engineer. Currently he is Full Professor at the Department of Electronics, leading several courses in the area of radio on the graduate and postgraduate study of information and communication technology. He was involved in organization and execution of several international conferences as an organizer or a technical committee member, and several national science projects as a project leader or a researcher. He appears as an author or coauthor of more than 90 journal and conference papers, two book chapters, and several studies in radio systems, channel modeling, antennas, radio-propagation and microwaves. He is a member of IEEE, Korema and CCIS. Currently, he serves as IEEE EMC Society Croatian Chapter Chair.*

BUSINESS FORUM

Friday, September 23, 16:30-18:00 (AGAVA)

WSEP: 11TH WORKSHOP ON SOFTWARE ENGINEERING IN PRACTICE

The software is everywhere around us. The significant growth of ICT products and solutions depends on the quality of the used software. The software is essential enabler of future usage and growth of networked society surrounded with connected devices. Are we ready for such mass software production and keeping the software product life cycle continuous? How are the current researches and used software engineering practice correlated and ready to take responsibility for such broad and demanding software usage with quality, security and energy efficiency demands? What are the software products in the “software-as-a-service” era? Are we aware of software architecture demands and software life-cycle management? What challenges in software engineering are the most critical? Let's take opportunity to discuss these software engineering challenges and exchange experience between researchers and practitioners. Prepare your view and share it with others. Be on the workshop during the SoftCOM 2022 conference.

MODERATOR: Darko Huljenic, PhD, Ericsson Nikola Tesla d.d., Zagreb

Biography:

Dr. Darko Huljenić received his Ph.D. degrees from the University of Zagreb, Croatia, in 2001. He has been with Ericsson Nikola Tesla since 1984. His current position is Director of Research Unit. He expanded company research cooperation with the major Croatian Universities as well as some international research institution's. His main interests are open network architecture, software development methodologies and service oriented architecture. Dr. Huljenic holds a position of associate professor at the University of Zagreb, at the Faculty of Electrical Engineering and Computing.

Development of a Reporting System based on Data Warehouse of eAssist Information System
Stipe Celar (University of Split & FESB, Croatia); Domina Amižić (University of Split, Croatia); Frane Plazibat (eAssist, Croatia); Bruno Lončar (Mimohello Company, Croatia)

Implementation of Digital Twin concept using Microsoft Azure platform
Domagoj Bazina and Toni Mastelic (Ericsson Nikola Tesla, Croatia)

Database management in a 5G network: Apache Geode benchmark and monitoring
Ante Turalija, Ivan Bakovic and Toni Mastelic (Ericsson Nikola Tesla, Croatia)

Friday, September 23, 16:30-18:00 (PALMA II)

WORKSHOP ON PROCESS COMPLIANCE AND CONTROL

The research results of the project System for real-time monitoring and control of distributed processes, anomaly detection, early warning and forensic transaction analysis – PCC will be presented through a special workshop as a part of the SoftCOM 2022 conference. The PCC (Process Compliance and Control) project is a cooperation of university and ICT industry, namely the cooperation between University of Zagreb Faculty of Electrical Engineering and Computing and Multicom.

The traditional way of discovering business processes was manual, tedious, and error prone. It was based on a series of meetings and workshops where business process analysts would talk to the various people in the organization, trying to reconstruct (discover) business processes occurring in the organization. Many of such projects failed, due to various unmanageable reasons: organization size (the number of people that needed to be talked to), willingness of people to participate in the process discovery project, and the level of technical details that needs to be understood by the business process analysts to correctly define organization processes. This is especially significant in technical industries, such as telecommunication industry, where business and operational systems collaborate in big end-to-end business processes, and where business process analysts need to understand both business and technical details to a sufficient degree to be able to discover business processes.

Recently, scientific researchers came up with a new approach in discovering organizational business processes, by mining data coming from traditional information systems. Data coming from databases, communication messages (service invocations for example), and data streams are being collected, enriched, transformed, and then used by various algorithms to reconstruct (discover) business processes. The aforementioned research focuses on various aspects of the business process discovery: how to sample data from traditional information systems, enrichment of the sampled data, transformations to simplify data, and then algorithms for the process discovery.

In this project we focused our research on creating a tokenized automata capable of capturing flows and sequences from the sampled data. As part of the research we started by envisioning the way how to sample data from the traditional information systems, which is then enriched (possibly temporally), and transformed into a set of data streams. Later, we consolidate these data streams by temporally ordering the data and transforming it into simple messages in the format (IEEE XES) that can be consumed by the developed tokenized automata. Then, the automata builds its structure based on the input messages. Tokens (as in Petri nets) where added to the automata to be able to track multiple process contexts at once in the same automata structure (instance). Such automata can be also used to perform business process compliance check, where we compare the data sampled from the information systems to the automata structure. Automata also collects statistics from the input messages, which can be further used to analyze frequency and regularity of the undertaken activities in the organization, and by that isolating more regular process flows, or flows that deems to be irregular or even anomalous.

Further research goes into adding data storage to the automata transitions, which would help to deeply analyze business objects in the context of the business process flows. This would allow to reveal some user intentions, flow decision regularities, and draw some semantic conclusions in the context of the business process flows.

This work was supported by the European Regional Development Fund through the Operational Programme Competitiveness and Cohesion 2014–2020, under the project System for real-time monitoring and control of distributed processes, anomaly detection, early warning and forensic transaction analysis – PCC (KK.01.2.1.02.0097).

MODERATORS:

Boris Vrdoljak, PhD, University of Zagreb

Biography: *Boris Vrdoljak is full professor at the University of Zagreb, Faculty of Electrical Engineering and Computing. He received his Ph.D. degree from the same faculty in 2004. He spent 3 months as a visiting researcher at the University of Bologna, Italy, and 12 months as postdoctoral researcher at INRIA institute, France. His research interests cover ontology matching, e-business security, data warehousing, and big data analytics. He is manager of the Faculty of Electrical Engineering and Computing team in the PCC project. Boris Vrdoljak is a member of the Centre of Research Excellence for Data Science and Advanced Cooperative Systems (ACROSS-DataScience), Data Streams Laboratory, and Laboratory for Information Security and Privacy. He is also president of the council of the postgraduate specialist study Information Security.*

Dalibor Krleža, PhD, University of Zagreb

Biography: *Dalibor Krleža is a principal researcher at the University of Zagreb, Faculty of Electrical Engineering and Computing. After finishing the graduate Computer Science study at the same faculty, he worked in the information industry as an IT architect and technical lead. In that time, he worked for big corporations, such as IBM, where he was in the role of technical lead for numerous big and valued projects. He was also a consultant in the Telecommunication industry, enabling some of the biggest transformation projects for IBM and various Telecommunication operators. In his Telecommunication consulting practice, his speciality was the order management automation. He received his Ph.D. degree from the same faculty in 2016. From 2017 he is working for the faculty on various scientific projects. He is a researcher and lecturer. His specific focus is applied mathematics, data structures, various advanced algorithms, and applied machine learning.*

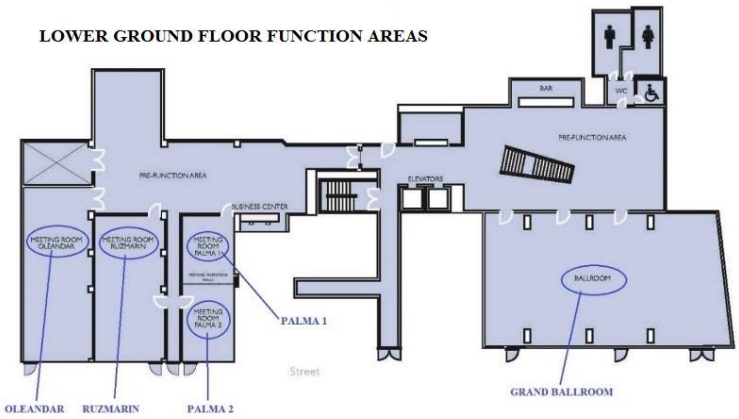
Luka Humski, PhD, University of Zagreb

Biography:

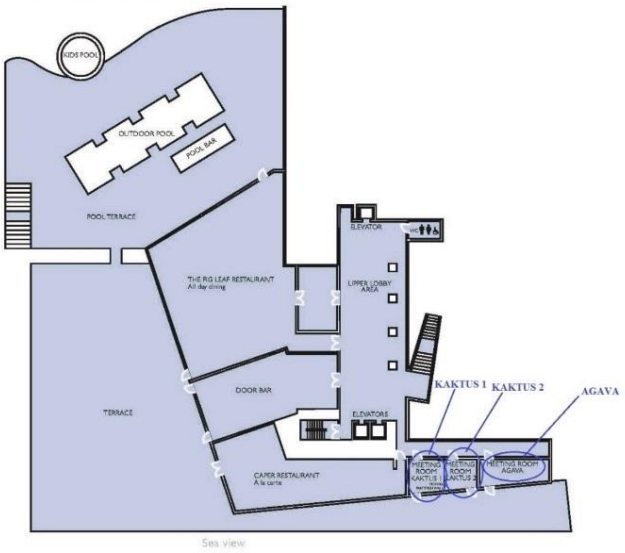
Luka Humski is a Postdoctoral Researcher at the University of Zagreb, Faculty of Electrical Engineering and Computing. He received the master's and Ph.D. degrees (both with summa cum laude) from the Faculty of Electrical Engineering and Computing. His research interests include synthetic data generation, social network analysis, data mining, machine learning, and electronic business. He works as a researcher on various science related projects.

FLOOR PLAN OF HOTEL RADISSON BLU AND GENERAL INFORMATION

LOWER GROUND FLOOR FUNCTION AREAS



FIRST FLOOR FUNCTION AREAS



ABOUT

The 30th International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2022) will be held in hybrid format (live and virtual) on September 22-24 in Split, Croatia.

ELECTRONIC PROCEEDINGS

Electronic Proceedings, USB Proceedings and Final Program will be available at conference website.

LANGUAGE

The Conference language is English.

SECRETARY

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SOCIAL PROGRAM

Guided tour in Split

Split is the largest city on the Croatian coast of the Adriatic Sea with a population of 180000. The visit of Split can offer the travelers an extraordinary city tour without any need to take buses to reach the center. Even today as you pass along the south promenade of the Palace, you can feel Diocle's spirit. You can also feel the light breeze blowing from the sea as it seems to be playing through the openings of the Cryptoporticus, welcoming to this town, travelers for whom as Diocles said, there will always be a bed, food and drink, music and the presence of God.

Conference Luncheon

In a pleasant atmosphere of the Radisson Blu Resort restaurant discover the gastronomic delights prepared by the chefs and feast your senses with the delicacies of Dalmatian cuisine. The Dalmatian cuisine is based on fresh ingredients, simple preparation with little intense spice, fresh herbs and wild plants. Dalmatia is rich with Mediterranean herbs, such as sage, bay leaves, rosemary, basil, thyme which give dishes a special aroma and taste. The traditional Dalmatian cuisine coincides with modern nutritional trends which prefer lightweight thermal processing of food and plenty of fresh fish, olive oil and vegetables.

SoftCOM 2022 Split, Croatia

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