2025 13th International Workshop on Advanced Ground Penetrating Radar (IWAGPR 2025)

Thessaloniki, Greece
2-4 July 2025

IEEE Catalog Number: CFP25538-POD
ISBN: 979-8-3315-2336-7

Copyright © 2025 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP25538-POD
ISBN (Print-On-Demand):	979-8-3315-2336-7
ISBN (Online):	979-8-3315-2335-0
ISSN:	2687-7880

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

Table of Contents

2D FDTD Numerical Modelling of GPR a Masonry Wall: an Application for Cultural Heritage Conservation in Central Italy.....1
Giorgio Alaia [1], Maurizio Ercoli [1], Nicola Cavalagli [2]
1. Department of Physics and Geology, Università degli Studi di Perugia, 2. Department of Civil and Environmental Engineering, Università degli Studi di Perugia

3-D Estimation of Horizontal Conducting Cylinder by Loop Array Antenna in a Vertical Borehole.....7
Satoshi Ebihara [1], Masaya Ito [1], Kodai Takamatsu [1]
1. Osaka Electro-Communication University

3D GPR Stratal Slicing of Sedimentary Structures.....12
Mark Grasmueck [1], Gregor Eberli [1]
1. RSMAS University of Miami, FL, USA

3D UWB Positioning System on Data Processing by ANN.....17
Vadym Plakhtii [1], Oleksandr Dumin [1], Lorenzo Capineri [2], Gennadiy Pochanin [3], Dmytro Havrylenko [4]
1. School of Radio Physics, Biomedical Electronics, and Computer Systems V.N. Karazin Kharkiv National University, 2. Dept. of Information Engineering, University of Florence, 3. Radiophysical Introscopy Department O.Ya.Usikov Institute for Radiophysics and Electronics of the NAS of Ukraine, 4. School of Radio Physics, Biomedical Electronics and Computer Science V.N. Karazin Kharkiv National University

A combined geophysical approach to imaging permafrost across varying ground types in the Inuvialuit Settlement Region.....22
Georgia Coote [1], Craig Warren [1], Michael Lim [1], James Martin [1], Rebecca Lee [2], Dustin Whalen [2]
1. Northumbria University, 2. Natural Resources Canada

A Framework for Evaluating the Degradation of UHPFRC Waterproof Layers in Bridge Decks Using GPR: A Numerical and Experimental Approach.....27
Mengda Wu [1], Amine Ihamouten [2], Etienne Bellenfant [3], Alexis Cothenet [2], Théo Dezert [1], Jérôme Tissier [2], Grégory Andreoli [4], Xavier Dérobert [5]
1. FI-NDT, 2. MAST/Lames - Université Gustave Eiffel, 3. APRR, 4. MAST/MIT - Université Gustave Eiffel, 5. GERS/GeoEND - Université Gustave Eiffel

A GPR Survey of Arctic Pingos.....31
John Bradford [1], Benjamin Hills [1], Roger Michaelides [2], Matthew Siegfried [1], Venezia Follingstad [1], Kynan Hughson [3]
1. Colorado School of Mines, 2. Washington University, 3. University of New Brunswick

Accelerating GPR Numerical Simulations via Machine Learning: A Sparse Multi-Offset and Supershot Framework.....36
Yuxin Liu [1], Antonis Giannopoulos [2], Deshan Feng [3], Xun Wang [3]
1. Central South University, 2. University of Edinburgh, 3. The School of Geosciences and Info-Physics, Central South University

Advanced Classification of GPR Data.....42
Richard Yelf [1], Daniel Yelf [1], Waleed Al-Nuaimy [2]

1. Georadar Pty Ltd, 2. University of Liverpool

Advanced interpretation tools for WISDOM, the ExoMars GPR. Validation on experimental data acquired in Svalbard, a Martian analogue.....48
Emile Brighi [1], Valérie Ciarletti [1], Alice Le Gall [1], Nicolas Oudart [1], Yann Hervé [1], Dirk Plettemeier [2], Wolf-Stefan Benedix [2], Aleksey Shestov [3], Esther Mas Sanz [4]

1. LATMOS, 2. TUD, 3. UNIS, 4. ETH Zürich

Advanced Techniques for Evaluating Trunk Health: Integrating 3D Photogrammetry with Dual-polarized GPR Survey.....54
Lilong Zou [1], Ying Li [2], Kevin Munisami [1], Amir M. Alani [1]

1. Kingston University, 2. Birkbeck, University of London

Airport Pavement Inspection through Multi-Static GPR Surveys Using Deep Neural Networks.....60
Lilong Zou [1], Ying Li [2], Kevin Munisami [1], Amir M. Alani [1], Motoyuki Sato [3]

1. Kingston University, 2. Birkbeck, University of London, 3. Tohoku University

An innovative long-range multi-offset GPR acquisition method: synthetic and real data testing.....66
Emanuele Forte [1], Giacomo Roncoroni [1], Michele Pipan [1]

1. University of Trieste

Application of ground penetrating radar and electrical resistivity tomography for recognizing cavities in critical urban areas: the case study of Muntplein (Amsterdam, The Netherlands).....71
Marios Karaoulis [1], Nectaria Diamanti [1], Chris Bremmer [2], Evert Slob [3], Dominique Ngan-Tillard [3], Pantelis Karamitopoulos [4]

1. Aristotle University of Thessaloniki, 2. Deltares, 3. Department of Geoscience & Engineering, Delft University of Technology, 4. Ingenieursbureau Gemeente Amsterdam

Bandwidth Enhancement of Cylindrical Borehole Radar Antenna Using Coaxial Line Feeder.....76
Ayodeji Matthew Monebi [1], Sang Hyun Kim [1], Seunghwan Lee [1], Sang-Wook Kim [1]

1. Isung GPR Corporation

Characterisation and diagnosis of timber floor of the Ajuda National Palace in Lisbon.....82
Simona Fontul [1], Rogério Mota [1], Marília Pereira [1], Helena Cruz [1], Luís Matias [1], Sónia Duarte [1], Ana Isabel Marques [1]

1. LNEC - National Laboratory for Civil Engineering

CNN-Based Crack Detection in Asphalt Pavements Using GPR: Intensity Map and Histogram Analysis.....87
Grigório Ribeiro Soares Neto [1], Francisco Manuel Carvalho Pinto Fernandes [2], Simona Fontul [3], Jorge Carvalho Pais [1]

1. University of Minho, 2. Lusíada University - North, 3. LNEC - National Laboratory for Civil Engineering

Comparative study of realistic and homogenized ballast layer.....91
Sepideh Harajchi [1], Evert Slob [1]

1. Department of Geoscience & Engineering, Delft University of Technology

Comparison of Theoretically Calculated Waves from a Dielectric Slab and Reflected Waves from an Actual Fracture in Rock in Polarization-Sensitive Directional Borehole Radar.....95
Satoshi Ebihara [1], Aito Matsuda [1], Masatsugu Fujimoto [1], Takuya Magawa [1]

1. Osaka Electro-Communication University

Depth CoordConv for Enhancing Unsupervised Domain Adaptation in Fully Convolutional Network-Based GPR Inversion.....101
Takanori Imai [1], Tsukasa Mizutani [1]

1. The University of Tokyo

Detailed GPR survey and UAV imaging for detecting gas vents – mofettes in NE Slovenia.....107
Marjana Zajc [1], Nina Rman [1]

1. Geological Survey of Slovenia

Detecting Agricultural Operations Combining SAR and Optical Data.....112
Andrea Soccolini [1], Sara Antognelli [2], Francesco Santaga [2]

1. Sapienza University of Rome, 2. Agricolus s.r.l.

Detection of Hyperbolic Reflections in GPR Data Using Faster R-CNN and Point Extraction.....117
Zeljko Bugarinovic [1], Aleksandar Ristić [1], Aleksandra Radulović [1], Miro Govedarica [1], Milka Šarkanović Bugarinović [1]

1. Faculty of Technical Sciences, University of Novi Sad

Detection of Tail Parts in Double-Layer Rebar Hyperbola Using Sobel Filters and Radon Transform.....122
Shunsuke Iwai [1], Tsukasa Mizutani [1]

1. The University of Tokyo

Detection water leaks in soils by stepped-frequency radar and continuous wavelet transform spectra.....127
Benhui Fan [1], Camille Herlent [2], Jean-Marie Fleureau [3], Alain Sylvestre [2], Cyrille Fauchard [1]

1. Cerema Endsum, 2. Univ. Grenoble Alpes, 3. CentraleSupelec

Development of a digital twin for airborne ground penetrating radar.....131
Ying Wang [1], Feng Zhou [2], Iraklis Giannakis [3], Antonis Giannopoulos [4]

1. China University of Geosciences (Wuhan), 2. China University of Geosciences(Wuhan), 3. University of Aberdeen, 4. University of Edinburgh

Earth Surface Effects in Ground-Penetrating Radar Responses.....135
Evert Slob [1], Nectaria Diamanti [2], Peter Annan [3]

1. Department of Geoscience & Engineering, Delft University of Technology, 2. Aristotle University of Thessaloniki, 3. AJPJA

End-to-end GPR System Simulation: Parameter Study and Optimization for Reconfigurable Design.....140
Léa Mercier [1], Yann Hervé [2], Valérie Ciarletti [1], Benoit Agnus [2]

1. LATMOS, 2. SCIENTEAMA

Estimating the size of scatterers in GPR data sets by means of a novel post-tracking diffraction analysis.....146
Matteo Dossi [1], Barbara Cosciotti [1], Sebastian Lauro [1], Elisabetta Mattei [1], Elena Pettinelli [1]

1. Roma Tre University

Evaluating guided-wave GPR velocity profiling and its potential in soil studies.....152
Sophie Stephan [1], Jens Tronicke [1], Philipp Koyan [1]

1. University of Potsdam

Evaluating subsurface roughness and antenna elevation effects by GPR forward modeling.....157
Ilaria Santin [1], Giacomo Roncoroni [2], Emanuele Forte [2]

1. ETH Zürich, 2. University of Trieste

Experience of Using GPR in Assessing Thin Asphalt Layer Thicknesses.....162
Christina Plati [1], Andreas Loizos [1], Alexandros Mouzakis [1]

1. National Technical Univeristy of Athens

Exploring Unprecedented GPR Penetration Depths in Low-Loss Sedimentary Environments: The Bødalen Delta Case, Western Norway.....167
Georgios Tassis [1], Nectaria Diamanti [2], Jan Steinar Rønning [1], Louise Hansen [1]

1. Geological Survey of Norway (NGU), 2. Aristotle University of Thessaloniki

Extended dynamic range GPR for bedrock detection: an effective approach in geotechnical applications.....173
Fabio Giannino [1], Alessandro Simi [1], Davide Pasculli [1], Davide Morandi [1]

1. IDS GeoRadar

Geophysical Investigation Using GPR and FEM to Detect Anthropogenic Structures in the Coastal Area of Artemis, Attica, Greece.....179
Stavros Karizonis [1], George Apostolopoulos [1]

1. National Technical Univeristy of Athens

Geophysical prospecting at the pre-Roman archaeological site of Monte Sannace (Apulia, Italy) 185
Gerardo Romano [1], Gregory De Martino [2], Domenico Patella [1], Michele De Girolamo [3], Davide Di Gennaro [4], Marco Di Lieto [5], Savino Gallo [6], Francesco Longobardi [6], Luigi Capozzoli [2]

1. Department of Earth and Geo-Environmental Sciences University of Bari Aldo Moro, 2. Institute for Methodologies for Environmental IMAA-CNR, 3. National institute of geophysics and volcanology (INGV), 4. National Research Council - Institute of Heritage Science (CNR-ISPC), 5. Di Lieto & C. s.r.l., 6. Castello Svevo di Bari - Direzione regionale Musei nazionale Puglia

GPR measurements in the eastern part of the Asse salt structure with examples from direction sensitive borehole radar on the 700-m-level.....189
Volker Gundelach [1]

1. Federal Institute for Geosciences and Natural Resources (BGR)

GPR performance for material characterization of existing end-of-life buildings.....194
Ourania Patsia [1], Alexandre Novo [1], Samuel Lehner [1], Miguel Clavijo [1]

1. Screening Eagle Technologies

GPR prospecting in the Saint Francis of Paola church in Rome.....199
Raffaele Persico [1], Paolo Zimmaro [1]

1. University of Calabria

GPR Signal Artifacts Caused by Reinforcing Bars.....203
Davide Campo [1]

1. Sandberg LLP

GPR-Based Subsurface Characterization in Support of Soil Response Studies.....209
Vega Perez [1], Oriol Caselles [1], Ramón González-Drigo [1]

1. Universitat Politècnica de Catalunya

Imaging tracer experiments using time-lapse crosshole GPR full-waveform inversion.....215
Anja Klotzsche [1], Peleg Haruzi [1], Harry Vereecken [1], Jan Vanderborght [1], Jan van der Kruk [1], Gabriel Rau [2], Hannah Gebhardt [3], Andreas Englert [3], Peter Bayer [3]

1. Agrosphere (IBG-3), Institute of Bio- and Geosciences, Forschungszentrum Jülich, 2. School of Environmental and Life Sciences, The University of Newcastle, 3. Applied Geology – Institute of Geosciences and Geography Martin Luther University Halle-Wittenberg

Impact of Completeness of Hyperbolic Data on GPR Detection using Hyperbolic Fitting.....220
Wenchao He [1], Wallace Wai-Lok Lai [1]

1. The Hong Kong Polytechnic University

Impact of Shallow Vegetation on the Detection of Buried Targets by GPR.....225
Michael Schneider [1], Thomas Walter [1], Hubert Mantz [1]

1. Ulm University of Applied Sciences

Integrating Back Projection and Full-Wave Inversion for Advanced Multilayer Reconstructions.....231
Zihan Xu [1], Xinfei Jin [2], Hongxu Li [2], Fulin Su [2], Guodong Xu [2], Sébastien Lambot [1]

1. Université Catholique de Louvain, 2. Harbin Institute of Technology

Integration of satellite data analysis with ground penetrating radar to map archaeological features in Al Aamerah, United Arab Emirates.....235
Sonia Alexandra Santos Assuncao [1], Diana Francis [1], Cherif Charfeddine [1], Moamen Ali [1], Mohammed Ali [1], Muhammad Asim Iqbal [1]

1. Khalifa University

Lidar-assisted Georeferencing of Multi-channel GPR data.....240
Victor Lu [1], Chun-Te Wu [1], Chuan-Chou Lu [1], Yau-Hsuan Tsai [1]

1. Industrial Technology Research Institute

Mapping and modelling of sand wedge polygons in saline alluvial sediments in the Atacama Desert using ground-penetrating radar.....246
Pablo Schwarze [1], Jan Igel [2], Brbara Blanco Arrué [2], Christof Sager [3], Alessandro Airo [3], Jenny Feige [3]

1. University of Chile, 2. LIAG - Institute for Applied Geophysics, 3. Museum für Naturkunde

Measuring Dielectric Constant of Soil Cores Based on GPR Transmission Measurements.....250
Kazunori Takahashi [1], Masaki Ono [1]

1. OYO Corporation

Microwave tomography enhanced UAV-GPR imaging: on field assessment at Altopiano di Verteglia (Avellino, Italy).....256
Giuseppe Esposito [1], Gianluca Gennarelli [1], Giovanni Ludeno [1], Francesco Soldovieri [1], Ilaria Catapano [2]

1. Institute for Electromagnetic Sensing of the Environment - National Research Council of Italy, 2. Institute for Electromagnetic Sensing of the Environment IREA-CNR

Monitoring of reinforced concrete degradation phenomena by GPR and other NDTs: a laboratory test.....261
Luigi Capozzoli [1], Gregory De Martino [1], Davide Di Gennaro [2], Giuseppe Salvia [1], Emilia Vasanelli [2], Stefania Imperatore [3], Cristina Monteleone [3], Hadi Monsef Ahmadi [3], Francesca Nerilli [3]

1. National Research Council - Institute of Methodologies for Environmental Analysis (CNR-IMAA), 2. National Research Council - Institute of Heritage Science (CNR-ISPC), 3. Department of Engineering Niccolò Cusano University, Rome, Italy

MS-TFNet: An unsupervised deep learning method for multi-frequency GPR data fusion in tunnel lining inspection.....266
Huaiyuan Zhou [1], Tess Luo [2], Yiqing Ni [1]

1. The Hong Kong Polytechnic University, 2. Shenzhen University

Multi-sensor cooperative robots for shallow buried explosive threat detection: radar sensors and optical sensors integrated by system software.....270
Lorenzo Capineri [1], Luca Bossi [1], Vadym Ruban [2], Emanuele Vivoli [3], Tim Becthel [4], Gennadiy Pochanin [2], Fronefield Crawford [5]

1. Dept. of Information Engineering, University of Florence, 2. Radiophysical Introscopy Department O.Ya.Usikov Institute for Radiophysics and Electronics of the NAS of Ukraine, 3. Dept.of Information Engineering, 4. Dept. of Earth and Environment Franklin and Marshall College, 5. Dept. of Physics and Astronomy Franklin and Marshall College Lancaster, PA, USA

Multi-sensor cooperative robots for shallow buried explosive threat detection: system architecture, mission strategy, and test field results.....275
Lorenzo Capineri [1], Pierluigi Falorni [1], Vadym Ruban [2], Tim Bechtel [3], Fronefield Crawford [4], Maksym Maiboroda [2]

1. Dept. of Information Engineering, University of Florence, 2. Radiophysical Introscopy Department O.Ya.Usikov Institute for Radiophysics and Electronics of the NAS of Ukraine, 3. Dept. of Earth and Environment Franklin and Marshall College, 4. Dept. of Physics and Astronomy Franklin and Marshall College Lancaster, PA, USA

Novel MCGPR technology applied to archaeological mapping at "El Caracol", Chichen Itza (Mexico).....279
Alexandre Novo [1], Ivan Ariel Rufino Contreras [2], Denisse Argote [3], Maximiliano Saucedo [2], Pedro López-García [4], Octavio Jurez [5]

1. Screening Eagle Technologies, 2. Geofísica Ambiental, 3. Instituto Nacional de Antropología e Historia, 4. INAH-Querétaro, 5. INAH-Yucatán

Numerical parametric study: effect of GPR source on MPM-inversion performances.....284
Mourougen Marimoutou [1], Khalil EL Khamlichi Drissi [2], Amine Ihamouten [3], Mengda Wu [4], David GUILBERT [5], Xavier Dérobert [5]

1. Université Clermont Auvergne, 2. université Clermont Auvergne, 3. MAST/Lames - Université Gustave Eiffel, 4. FI-NDT, 5. Université Gustave Eiffel

Optimal Height for Ground Coupled GPR.....289
David Redman [1], Nectaria Diamanti [2], Peter Annan [3], Steven Jackson [1]

1. Sensors & Software, 2. Aristotle University of Thessaloniki, 3. AJPJA

Optimizing FDTD EM boundary conditions.....295
Giacomo Roncoroni [1], Elisa Ligas [1], Børge Arntsen [2], Emanuele Forte [1], Michele Pipan [1]

1. University of Trieste, 2. NTNU

Performance evaluation of AI segmentation networks for GPR data interpretation.....299
Davide Pasculli [1], Marco Capitani [1], Michal Pryczek [2], Lukasz Cyran [2], Jakub Niedzwiedzki [2], Alessandro Simi [1]

1. IDS GeoRadar, 2. Hexagon AB

Perspective approaches to landmine detection, identification and positioning.....303
Gennadiy Pochanin [1], Iryna Pochanina [2], Tetiana Ogurtsova [1], Fronefield Crawford [3], Lorenzo Capineri [4], Tim Becthel [5]

1. Radiophysical Introscopy Department O.Ya.Usikov Institute for Radiophysics and Electronics of the NAS of Ukraine, 2. Lab. of Mathematical Physics O.Ya.Usikov Institute for Radiophysics and Electronics of the National Academy of Science of Ukraine, 3. Dept. of Physics and Astronomy Franklin and Marshall College Lancaster, PA, USA, 4. Dept. of Information Engineering, University of Florence, 5. Department of Earth & Environment Franklin & Marshall College

Polarimetric Viewpoint Correction for Ground Penetrating Radar Data.....308
Fernando Rial [1], Christian Bru [1], Thoetphan Kingsuwannaphong [1], Stefan Rmmler [1]

1. Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR

Positioning of Ground Penetrating Radar Assisted by Transmission Tower Response Signal.....314
Fuyou Zhang [1], Xiaoxian Tang [1], Junkai Ge [2], Xinna Tian [1], Zhiqiang Liu [1], Cuiwei Lun [1], Qian Kang [1], Bowen Lu [1]

1. State Grid Shandong Electric Power Company Construction Company, 2. Shandong University

Possibilities for reducing FWI calculation costs for GPR multi-offset data.....318
Bingchao Li [1], Anja Klotzsche [2], Jan van der Kruk [2], Dominik Hoven [2], Xun Wang [1], Deshan Feng [1]

1. The School of Geosciences and Info-Physics, Central South University, 2. Agrosphere (IBG-3, Institute of Bio- and Geosciences, Forschungszentrum Jülich

Preliminary Study on Automating Rebar Detection in Reinforced Concrete Structures Using YOLOv11 and GPR Data.....323
Ahmed Elseicy [1], Mercedes Solla [1], Alexandre Novo [2]

1. Universidade de Vigo, 2. Screening Eagle Technologies

Projecting and positioning unknown trajectories of MCGPR swaths.....329
Yimin Zhou [1], Wallace Wai-Lok Lai [1]

1. The Hong Kong Polytechnic University

Recent developments and possible applications of the 2.5D GPR full-waveform inversion for high resolution subsurface imaging.....334
Dominik Hoven [1], Jan van der Kruk [1], Craig Warren [2], Harry Vereecken [1], Anja Klotzsche [1]

1. Agrosphere (IBG-3, Institute of Bio- and Geosciences, Forschungszentrum Jülich, 2. Northumbria University

Reconstruction of Airborne Radargrams Using a Generative Adversarial Network Trained on Synthetic Data.....338
Minyu Li [1], Gabe Redding [1], Patrice Delmas [2], Morio Fukuoka [3], Sam McColl [4], Steven Le Moan [5], Daniel Parker [6]

1. Massey University, 2. The University of Auckland, 3. Moritech, 4. GNS Science, 5. NTNU, 6. inSite Archaeology Ltd.

Research on Rapid Acquisition of Ice Crack Morphology Using a Decision Tree Fusion Model with FP-GPR.....343
Xuan Feng [1], Liulei Wang [1], Haoqiu Zhou [2], Jiarun Yang [2], Zejun Dong [2], Yuheng Wang [2], Yafei An [2], Wenjing Liang [1]

1. Jilin University, 2. Jilin university

Robotics and GPR in agriculture.....348
Vega Perez [1], Nuria Rodríguez Calderón [1], Marc Sanchez Atienza [1], David Caballero [1], Adriano Liso [2], Carles Domenech [1]

1. Universitat Politècnica de Catalunya, 2. National Research Council of Italy

Soil water retention curve parameters estimation based on ground penetrating radar full waveform inversion with an improved grey wolf optimizer.....354
Minghe Zhang [1], Maksim Bano [2], Xuan Feng [1], Haoqiu Zhou [3], Zejun Dong [3], Yafei An [3]

1. Jilin University, 2. University of Strasbourg, 3. Jilin university

Strategies for GPR peatland characterisation.....360
Jan Igel [1], Bárbara Blanco Arrué [1], Tobias Splith [1], Stephan Costabel [2], Mike Müller-Petke [1]

1. LIAG - Institute for Applied Geophysics, 2. Federal Institute for Geosciences and Natural Resources

Study on time-lapse detection and polarization response characteristics of cracks with FP-GPR based on H-Alpha decomposition.....365
Xuan Feng [1], Yafei An [2], Haoqiu Zhou [2], Jiarun Yang [2], Zejun Dong [2], Wenjing Liang [1], Yuheng Wang [2], Liulei Wang [3]

1. Jilin University, 2. Jilin university, 3. College of Geo-Exploration Science and Technology Jilin University

Sustainability of Bronze Age Monuments at Oman: GPR imaging at an archaeogeophysical laboratory.....369
Nikos Economou [1], Khaled Douglas [2], Muhammad Younis Khan [3], Mohamed Hesein [4], Nasser Al-Jahwari [4], Sara Pizzimenti [5], George Kritikakis [6], Bader Al-Shaqsi [3], Said Al-Abri [3]

1. School of Mineral Resources Engineering, Technical University of Crete, 2. Archaeology Department Sultan Qaboos University Muscat, Oman and The Hashemite University Zarqa, Jordan, 3. Earth Sciences Department Sultan Qaboos University Muscat, Oman, 4. Archaeology Department Sultan Qaboos University Muscat, Oman, 5. Dipartimento di Civiltà e Forme del Sapere Università di Pisa Pisa, Italy, 6. School of Mineral Resoures Engineering Technical University of Crete Chania, Greece

Teaching GPR data processing methods using the Jupyter environment (from A-scan to C-scan).....375
Albane Saintenoy [1], Emmanuel Léger [1], Nicolas M. Thiéry [2]

1. Université Paris Saclay, CNRS, GEOPS, 2. Université Paris Saclay, CNRS, LISN

The Application of the Short Chirp GPR system to the Shield Machine.....379
Toshimitsu Nozu [1], Kiyoshi Yoshida [1], Yashuhiro Ishikawa [1], Kenyu Sakao [1], Toshimune Imai [1], Yoshitaka Imado [1]

1. Kawasaki Geological Engineering

The method of the diffraction curves for retrieving the dielectric permittivity in a layered medium....383
Raffaele Persico [1], Ding Yang [2], Gianfranco Morelli [3], Ilaria Catapano [4], Giuseppe Esposito [4], Gregory De Martino [5], Luigi Capozzoli [5]

1. University of Calabria, 2. University of Electronic Science and Technology of China, 3. Geostudi Astier s.r.l.„ 4. Institute for Electromagnetic Sensing of the Environment IREA-CNR, 5. Institute for Methodologies for Environmental IMAA-CNR

The potential of 3D GPR for imaging and characterizing permafrost regions.....387
Philipp Koyan [1], Jens Tronicke [1], Julien Guillemoteau [1], Pier Paul Overduin [2]

1. University of Potsdam, 2. Alfred Wegener Insitute, Helmholtz Centre for Polar and Marine Research

Three-dimensional Finite-Difference Time-Domain Modeling of Ground Penetrating Radar Survey for Buried Paleo-Channel Detection.....391
Changwan Sun [1], Takao Kobayashi [2], Youngbeom Cheon [2], Jin-Hyuck Choi [2]

1. University of Science and Technology, 2. Korea Institute of Geoscience and Mineral Resources

Time Domain Projection for Real-Time Side-Looking GP-SAR.....395
Johannes Schlichenmaier [1], Bernd Arendt [1], Winfried Mayer [1]

1. FindMine gGmbH, Illertissen

Time-lapse electrical resistivity tomography and ground penetrating radar for moisture monitoring in monuments' walls: the Thessaloniki's Rotunda case.....401
Prodromos Louvaris [1], Panagiotis Tsourlos [1], Nectaria Diamanti [1], George Vargemezis [1], Gregory Tsokas [1], Konstantinos Polydoropoulos [1], Georgia Zacharopoulou [2]

1. Aristotle University of Thessaloniki, 2. Ministry of Culture

Trace-to-IFC: Integrating Layer Thickness from GPR data into BIM.....407
Mercedes Solla [1], Sofía Calvar [1], Ahmed Elseicy [1], Gemma Guillamón-Andreu [1], Paula Pudell [1], Mario Soilán [1]

1. Universidade de Vigo

Utilizing GPR to Develop Digital Twins across Maturity Levels for Underground Infrastructure Mainte-nance.....413

Huamei Zhu [1], Feng Xiao [1], Yimin Zhou [2], Mengqi Huang [3], Wallace Lai [2], Qianbing Zhang [1]

1. *Monash University,* ***2.*** *The Hong Kong Polytechnic University,* ***3.*** *Swinburne University of Technology*