



6th Joint
International Symposium
on Deformation Monitoring
07.-09.04.2025

6th Joint International Symposium on Deformation Monitoring

Preliminary Programme

Major changes possible

07.– 09.04.2025



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Programme – Overview

Monday, 07.04.2025		
08:00 - 09:00	Registration	
09:00 - 10:00	Opening Ceremony	
10:00 - 10:45	Keynote: "The role of stress for safe water reservoir operation"	
10:50 - 12:20	Trends in deformation analysis	Enhanced deformation monitoring by means of data fusion I
12:20 - 13:15	Lunch break	
13:15 - 14:45	Research Unit "TLS-Defo": An holistic approach for TLS-based dam monitoring	Enhanced deformation monitoring by means of data fusion II
14:45 - 15:15	Coffee break	
15:15 - 17:15	Remote structural health monitoring	Dynamic structural health monitoring
20:00	Ice breaker party	
Tuesday, 08.04.2025		
08:30 - 10:00	Quality assurance in deformation monitoring	Machine learning for deformation analysis
10:05 - 10:35	Teaser presentations A (poster)	
10:35 - 11:15	Poster session (with coffee break)	
11:15 - 12:45	Surface reconstruction as a basis for deformation analysis	Sponsors' presentations
12:45 - 13:45	Lunch break	
13:45 - 14:30	Keynote: "Why geodesy is needed for monitoring, or why not"	
14:35 - 16:05	Advanced point cloud analysis strategies for deformation analysis	InSAR for deformation monitoring I
16:05 - 16:30	Coffee break	
16:30 - 18:00	Alpine geomonitoring with TLS	InSAR for deformation monitoring II
20:00	Dinner	
Wednesday, 09.04.2025		
08:30 - 10:00	About the importance of stochastic information in deformation analysis	Terrestrial radar for deformation monitoring
10:05 - 10:35	Teaser presentations B (poster)	
10:35 - 11:15	Poster session (with coffee break)	
11:15 - 12:45	Feasibility studies: New sensors for deformation monitoring	Innovative approaches for deformation monitoring
12:45 - 13:45	Lunch break	
13:45 - 15:15	Advanced approaches for total station-based deformation monitoring	Challenges in GNSS-based deformation monitoring
15:20 - 16:05	Keynote: "Combination for simulation models and deformation monitoring in structural dynamics"	
16:05 - 16:30	Closing	

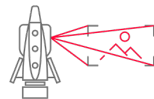
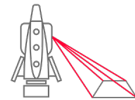
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Keynotes

Monday, 07.04.2025, 10:00 - 10:45, [Room A](#)

“The role of stress for safe water reservoir operation”

Frank R. Schilling, Birgit I. R. Mueller

The Enguri-high-dam was chosen for the study of water level induced seismicity due to its height of 271 m and extraordinary water level variations. On site-research allows to quantify underlying processes and mechanisms of dam-environment interactions – to reduce risks for public and the environmental impact. The interdisciplinary collaborative effort www.DAMAST-caucasus.de initiated a transfer to enhance the lifetime of Enguri-High-Dam supplying 40% of Georgian electricity demand.

THE CHALLENGE(S): Earthquakes are triggered by stress modifications in the underground. Hence the question arises, how is induced seismicity connected to water level changes? What are potential risks of water dams for environment and population? The answers require an improved understanding of processes in the underground. What is the share of sedimentation into a reservoir and pore-pressure stress coupling through water level variations on induced seismicity?

METHODOLOGIES: In the DAMAST projects research on methods for a comprehensive deformation monitoring system around, at and within the Enguri Arch Dam, has been ongoing since 2019. To study the seismicity a dedicated seismological network was established at the dam which is able to detect even micro-seismic events. Historical and operational data as well as the results of the new observations serve as basis for the analysis. This allows to identify correlations between different processes and mechanisms as well as to derive recommendations for a safer operation of the facility.

RESULTS In addition to established methods, new concepts such as the successful testing of GB-SAR for dam deformation monitoring have been implemented and Artificial Intelligence (AI) methods were used. Numerous, up to 300 m deep drill holes had been drilled in the vicinity of the dam and have been monitored with modern borehole logging tools as well as with hydraulic fracturing to deduce the state of stress, which turned out to be mainly influenced by local topography. The influence of periodic water level fluctuations on the regional deformation as well as the structural deformation of the dam could be shown using PSInSAR, 3D terrain and dam models

and GB-SAR measurements. Increasing water levels lead to subsidence and sideways displacement of the lake shores and deformation of the dam itself. Large-scale numerical models provide information on the deformation behavior of the dam embankment and enable to calculate the distribution of shear and Coulomb Failure stresses based on the compiled stress data. Modelling results have been compared with the time series and location of the micro-seismicity. Model data, geometries and measurement data are then used to train a Convolutional Neural Network (CNN).

The projects focus on the SDGs of clean energy, environment and climate protection which are linked to SDGs of innovation and infrastructure, good jobs, economic growth and poverty reduction. Inherent are contributions to the quality of education. he trained young researchers have the potential to play a decisive role within future authorities, e.g. for project approval and control. This is extremely relevant to achieve the SDGs and for the direct users such as owners of hydropower and irrigation reservoirs.

Tuesday, 08.04.2025, 13:45 - 14:30, Room A

“Why geodesy is needed for monitoring, or why not”

Andreas Wieser

Deformation monitoring based on multi-epoch network measurements and statistically strict testing for differences of network geometry was an important contribution of (engineering) geodesy to many application fields. It still is. But for many applications, data acquisition with a variety of sensors has become easy and cost effective. Solutions range from embedded and in-situ sensing via classical geodetic methods to air- and spaceborne remote sensing with sometimes highly automated processing pipelines. Machine learning already supports the data analysis and may soon bridge the gap between data processing and interpretation. What does this mean for geodesists? Should they “go with the flow”? Are their key competences not unique enough anymore or even becoming obsolete? In this presentation, I will try a high-level look at the development of the fields of deformation monitoring, and the role of geodesy.

Wednesday, 09.04.2025, 15:20 - 16:05, [Room A](#)

“Combination of simulation models and deformation monitoring in structural mechanics”

Steffen Freitag, Ba Trung Cao, Nicola Gottardi, Anastasiia Volovikova, Günther Meschke

The performance and the reliability of engineering structures, e.g. bridges, tunnels or buildings, have to be assessed by structural models, which are used to compute the structural response (e.g. displacements and stresses of the structural components) according to the expected loads and environmental conditions. This includes not only the final structural state but also the construction process. Additionally, the health state of the structure may change during its lifetime, which needs to be considered within the reliability and safety assessment. In general, the structural response can be represented as time-variant processes of structural quantities of interest, which are dependent on the time-variant loads and material parameters.

Deformation monitoring is an important approach to observe the structural state during construction and during the service life of the structure. Real-time applications enable to compare continuously monitored deformation data with a priori computed deformations and to check specific threshold values, e.g. within a structural warning system. In addition to structural inspections, deformation monitoring can help to assess the structural health state or to identify unknown load and boundary conditions of the structural models. This requires to combine deformation monitoring with structural simulation models, which is the focus of this presentation. To achieve real-time performance of computational expensive simulation models, surrogate modeling strategies based on artificial neural networks will be presented. Additionally, the consideration of uncertainties will be discussed.

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Technical programme

Monday, 07.04.2025, 10:50 - 12:20, **Room A**

Trends in deformation analysis – Extensive solutions for deformation monitoring

W. Niemeier

50 Years of Deformation Monitoring - What has been achieved?

H. Kutterer, M. Even, A. Seidel, J. Weisgerber

Bridging the scales - Earth observation infrastructure and geodetic deformation monitoring

D. Czerwonka-Schröder, F. Schulte, W. Albert, K. Hosseini, R. Tabernig, Y. Yang, B. Höfle, Ch. Holst, K. Zimmermann

Almon5.0 - Real-time monitoring of gravitational mass movements for critical infrastructure risk management with AI-assisted 3D metrology

K. Karsznia, E. Świerczyńska, K. Książek, W. Odziemczyk

Development of an expert system for the deformation monitoring of historical sites using Artificial Intelligence (AI)

Monday, 07.04.2025, 10:50 - 12:20, **Room B**

Enhanced deformation monitoring by means of data fusion I

D. Bolkas, M. Olsen, E. Che, C. Simpson

First steps towards creating multi-sensor DEMs using optimal weighting for monitoring applications

N. Dal Santo, A. Michellini

A data fusion approach for combined Terrestrial Radar Interferometry (TRI) and Robotic Total Station (RTS) monitoring

T. V. Pattela, L. Disperati, E. D'Addario, D. Rappouli

Multi-Temporal GNSS, RTS, and InSAR for Very Slow-Moving Landslide Displacement Analysis

A. Seidel, M. Even, M. Westerhaus, H. Kutterer

Surface displacement monitoring and geophysical source modeling at the gas storage cavern field Epe

Monday, 07.04.2025, 13:15 - 14:45, **Room A**

Research Unit “TLS-Defo”: An holistic approach for TLS-based dam monitoring

E. Koller, B. Jost, H. Kuhlmann

Towards the calibration of terrestrial laser scanners – A case study at a concrete water dam

O. Abdelgafar, Ch. Holst

An efficient strategy for determining (scaled) intensity-based range variances of terrestrial laser scanners for rigorous deformation analyses

E. Ötsch, C. Harmening, H. Neuner

Employing variance component estimation for point cloud based geometric surface representation by b-splines

S. Sadiq, C. Harmening

Investigating the potential of stochastic relationships to model deformations

Monday, 07.04.2025, 13:15 - 14:45, **Room B**

Enhanced deformation monitoring by means of data fusion II

M. Scaioni, E. Realini, L. Ferrario, F. Roncoroni, S. Barindelli, D. Ravasi, R. Eskandari, F. Sansò, L. Barazzetti, M. Garramone, M. Previtali
HeMOC: a Project for integrated Monitoring of Cultural Heritage in Como Town, Italy

N. Wielgocka, G. Józków, D. Teodorczyk

Classifying surface displacements in mining regions using differential terrain models and coherence analysis

F. Grassi, P. Rossi, B. Brunelli, F. Mancini, C. Castagnetti, L. Vincenzi, E. Bassoli, A. Capra

Ensembling satellite monitoring and numerical cartography towards the safety assessment of infrastructures

M. Montuori

Digital elevation model and the enhancement of out-of-plane masonry deformation assessment

Monday, 07.04.2025, 15:15 - 17:15, **Room A**

Remote structural health monitoring

V. Belloni, N. E. Deresse, A. Nascetti, E. Verstrynge

Crack monitoring of masonry walls with enhanced Digital Image Correlation methods

Ch. Gaus, B. Jost, T. Piert, Ch. Hesse, K. Holste, H. Kuhlmann

Analysis and optimization of the reliable hole detection in sheet pile walls

A. Algadhi, P. Psimoulis, A. Grizi, L. Neves

Impact of surface orientation of structures on their seasonal deformation: a case-study in the UK

J. Backhaus, V. De Arriba Lopez, P. M. Achancaray Diaz, M. Maboudi, B. Riedel, U. Bestmann, M. Gerke

Signalization-free coregistration methods of multiscale and multitemporal survey and image information for structural monitoring

N. C. Meyer, T. Medic, E. Friedli, A. Wieser

Investigation of different registration methods for TLS-based deformation analysis of hydroelectric dams – A case study

Monday, 07.04.2025, 15:15 - 17:15, **Room B**

Dynamic structural health monitoring

R. Gao, B. Zhang

Real-Time Deformation Monitoring of the Long-span Bridge Using GNSS PPP-RTK

X. An, X. Meng, L. Hu, Y. Xie, F. Zhang

Integrated GNSS Positioning and Attitude Determination for Structural Health Monitoring of Large-span Bridges

G. Piniotis, T. Mpimis, V. Gikas

Dynamic Behavior Monitoring and Condition Assessment of a Multi-span Beam Bridge Complex Based on Long-Period Sensing Data

C. Xue, G. Li, J. Geng, P. Psimoulis

Evaluation of GNSS-smartphone performance in monitoring dynamic motion

J. M. O. Jayamanne, P. Psimoulis, J. Owen, N. Penna, C. Xue

Incorporating Low-Cost GNSS Receivers for Deformation Monitoring in High-Rise Buildings

Tuesday, 08.04.2025, 08:30 - 10:00, **Room A**

Quality assurance in deformation monitoring

Th. Pfaffinger, M. A. Ortiz Rincón, A. Nothnagel, Ph. Mey, Ch. Holst
Strategies for quality-controlled deformation analysis of radio telescopes' main reflectors applied to SARA0 Hartebeesthoek site

F. Schill, M. Horn, Th. Moser, W. Lienhart

Investigating the precision of remote geodetic sensors for bridge monitoring: a large-scale field study

R. Maalek

Digital Twin Model Calibration of Prefabricated Structural Systems under Visible Deformation: Recovering the Joint Fixity of a Cantilever Steel Space Frame Structure subjected to Static Displacement using Laser Scanning

M. Wagner, B. Jost, L. Klingbeil, H. Kuhlmann

Efficient and accurate? – Evaluation of a mobile mapping system in the context of road surface monitoring

Tuesday, 08.04.2025, 08:30 - 10:00, **Room B**

Machine learning for deformation analysis

J. Stähle, A. Volovikova, S. Freitag, A. Stark

Artificial Intelligence-Based Deformation Analysis for Damage Identification in Structural Health Monitoring

K. Wang

A deep learning bridge deformation prediction model based on generative AI

C. Hancock, C. Hill, P. Bhatia, J. Starkey, A. Athab, L. Yang, A. Arcia, A. Wong

Low-Cost GNSS Ground Monitoring for Land Planning: AI-Integrated Geospatial Solutions

S. Mitra

Identification and Active Deformation Analysis of Landslides Using Statistical Approaches, Machine Learning Algorithms based on SAR Interferometry results: A Case Study of Manutuke and Xiongba Landslides

Tuesday, 08.04.2025, 11:15 - 12:45, [Room A](#)

Surface reconstruction as a basis for deformation analysis

L. M. Stausberg, N. Quadt, B. Jost, H. Kuhlmann

Investigating of the applicability of surface models for laser scanner-based deformation analyses

R. Lindenbergh, D. Thomas, H. Daan

Assessing 3D morphological dune changes using ridge-, through- and curve skeleton lines

L. Winiwarter, K. Anders, B. Jutzi

Assessing the Potential of Neural Radiance Fields and Gaussian Splatting for Change Detection and Change Quantification

Ch. Michel, M. Ullrich

Automatic Inspection of Punched Metal Plate Fasteners on Timber-to-Timber Joints with Image-Based 3D-Reconstruction

Tuesday, 08.04.2025, 11:15 - 12:45, [Room B](#)

Sponsors' presentations

M. Rutschmann (Senior Product Manager, Leica Geosystems AG)

Autonomous and Automated Railway Deformation Monitoring

E. Burth (Managing Director RIEGL Germany) and K. Zimmermann (DMT Group)

Efficient infrastructure and deformation monitoring using laser scanning

Daniel Blersch (Senior Application Engineer, Zoller + Fröhlich GmbH)

Efficient data capturing for high demands

Tuesday, 08.04.2025, 14:35 - 16:05, **Room A**

Advanced point cloud analysis strategies for deformation analysis

O. Geißendörfer, Ch. Holst

Vibration monitoring based on LiDAR by observation fusion and spatio-temporal processing of point clouds

R. Tabernig, W. Albert, H. Weiser, B. Höfle

A hierarchical approach for reliable, fast, and near real-time 3D surface change analysis of permanent laser scanning point clouds

A. Voordendag, D. Haener, A. Wieser

Plane-based deformation analysis of railway tracks using airborne laser scanning data

M. E. Kowalska, J. Zaczek-Peplinska

Exploring Planar Projection of Point Clouds: A Case Study with Cylindrical Objects

Tuesday, 08.04.2025, 14:35 - 16:05, **Room B**

InSAR for deformation monitoring I

M. Omidalizarandi, P. K. Kirui, A. C. Kalia

Advanced Regional-Scale Anomaly Detection Using Persistent and Distributed Scatterer Interferometry with Vector-Autoregressive Time Series Analysis

K. Shahryarinia, M. Omidalizarandi, M. Heidarianbaei, M. A. Sharifi, I. Neumann

Detecting Change Points in Time Series of InSAR Persistent Scatterers Using Deep Learning Models

J. Hu, W. Wu, Q. Sun

Deformation Monitoring for Buildings with Time-series InSAR Point Cloud

D. Liu, J. Guo, J. Wang

Development of a satellite-based InSAR processing platform and its application in the mountainous region of Southwest China

Tuesday, 08.04.2025, 16:30 - 18:00, **Room A**

Alpine geomonitoring with TLS

N. Shi, T. Medic, N. Meyer, A. Voordendag, A. Wieser

Quantifying and reducing uncertainty of 3D displacement estimates from terrestrial laser scanner point clouds: A case study in Alpine geomonitoring

Y. Yang, D. Czerwonka-Schröder, Ch. Holst

Using point cloud registration to mitigate systematic errors in permanent laser scanning-based landslide monitoring

K. Hosseini, J. Hummelsberger, S. Zubareva, Ch. Holst

Advanced Real-Time 4D Landslide Monitoring Using Point Cloud Data with Contour Line Application and Feature Tracking for Predicting Future Movements

Tuesday, 08.04.2025, 16:30 - 18:00 **Room B**

InSAR for deformation monitoring II

M. Crosetto, S. Shahbazi, A. Barra

Mapping building differential deformations over wide areas

R. Eskandari, M. Scaioni

Joint Use of EGMS and Cosmo-SkyMed InSAR for Assessment of Ground and Structural Deformations: The Case of Como, Northern Italy

V. K. Maurya, S. Mitra, R. Dwivedi

Investigating surface deformation kinematics of Stromboli volcano using Multi-Temporal SAR Interferometry

A. Piter, M. Haghighi, M. Motagh

Temporary coherent scatterer selection for transport infrastructure monitoring with Sentinel-1 InSAR

Wednesday, 09.04.2025, 08:30 - 10:00, **Room A**

About the importance of stochastic information in deformation analysis

J. A. Butt, A. Wieser

Building and Solving Deep Stochastic Instrument Models with CaliPy

M. Lösler, C. Eschelbach, R. Lehmann

Impact of mathematical correlations in industrial applications

G. Kerekes, V. Schwieger

Correlations in TLS point clouds: Should we care about them?

K. Snow, B. Schaffrin

Total Least-Squares Collocation for Deformation Analysis

Wednesday, 09.04.2025, 08:30 - 10:00, **Room B**

Terrestrial radar for deformation monitoring

A. Michelini, N. Dal Santo, G. Alli, C. Testa

Water multipath effect in Terrestrial Radar Interferometry (TRI) for open-pit mine monitoring

A. Schenk, M. Rebmeister, R. Dujardin, A. Zarate Uribe, R. Zorn

A neural network approach to estimate the contribution of atmospheric variance in GBSAR time series

M. Rebmeister, A. Schenk, S. Hinz, F. Andrian, M. Vonié

Ground-Based InSAR and GNSS integration for enhanced dam monitoring

Wednesday, 09.04.2025, 11:15 - 12:45, **Room A**

Feasibility studies: New sensors for deformation monitoring

P. Krnjak, A. Kosor, H. Tomić, A. Marendić, R. Paar

Comparative Analysis of Volume Estimation Accuracy Using Low-Cost Mobile Phone Lidar and Traditional Geodetic Methods

A. Boney, S. Nishiyama, O. Murakami, S. Akita

A Feasibility Study to Monitor Crack Width Displacement using Images Taken with PTZ Cameras

F. Pollinger (GKGM)

GKGM-Award ceremony (J. Guillory)

J. Guillory

Field measurements over kilometres with sub-millimeter uncertainties using the Arpent two-wavelength EDM

Wednesday, 09.04.2025, 11:15 - 12:45, **Room B**

Innovative approaches for deformation monitoring

C. Qiu, S. Pytharouli, J. Souter

Ground motion baseline analysis using tilt sensors

X. Liu, J. Wang, C. Hancock

IMU based structural health monitoring of floodlights

E. Barnefske, C. Semmelroth, A. Scheider, H. Sternberg

Determination of the coordinates of a circle using distributed fibre-optic length changes

F.-B. Cartiaux, J. Semiao, A. Mege-Ythier

Deformation monitoring and model updating: three case studies on the Paris Metro

Wednesday, 09.04.2025, 13:45 - 15:15, **Room A**

Advanced approaches for total station-based deformation monitoring

L. García-Asenjo, R. Luján, S. Baselga

Mitigation of the refraction error in surveying techniques by using a network of meteorological sensors and a 3D refractivity model

A. Knöpfler

Deformation measurements on emergency sites

F. Schulte, D. Czerwonka-Schröder, M. Lösler

Automatic geodetic monitoring with total stations based on open source software library JAG3D - Case study of a rockfall in Trier/Germany

J. Zaczek-Peplinska, M. E. Kowalska

Principles and Case Study of IMSGeo: Automatic Displacement Monitoring System for Construction Sites

Wednesday, 09.04.2025, 13:45 - 15:15, **Room B**

Challenges in GNSS-based deformation monitoring

R. Xi, Q. Chen, W. Jiang, X. Meng

Numerical modeling and analysis of GNSS diffraction error in complex environments

Q. Huang, W. Yu, W. Dai

A machine learning-based approach in outlier detection for GNSS bridge deformation monitoring

W. Dai, Y. Wen, W. Yu

The usability evaluation and data processing methods of GNSS deformation monitoring in challenging environment

G. Ferhat, X. Wanner, M. Vidal, J.-P. Malet

Challenges and limitations in geodetic monitoring of landslides, case-study of Viella (Pyrenees mountains) and La Valette (Southern Alps), France



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Poster sessions

Tuesday, 08.04.2025, 10:05 - 11:15, [Room A](#) + [Room C](#)

M. Ulm, M. Elias, A. Eltner, E. Lotsari, K. Anders

Automated change detection in photogrammetric 4D point clouds – Transferability and extension of 4D objects-by-change for monitoring riverbank dynamics using low-cost cameras

S. Łapiński, P. Mąkowski

Detection analysis of displaced connection points for a different type of engineering survey networks connections

P. Wyszowska, R. Duchnowski

Sliding window algorithm applied to Msplint estimation for seasonal change detection from LiDAR data

J. Steinbach, C. Harmening

Laser scanning based deformation analysis of a wooden dome under load

M. C. Ramlie, P. Olea Encina, Ch. Magnard, T. Strozzi, O. Monserrat, M. Crosetto, Ch. McDermott

The Potential of PSI Time Series Analysis for the Monitoring of the Geobattery Project

P. Olea Encina, M. Ramlie, M. Crosetto, O. Monserrat

Analyzing the Impact of Soil Moisture Dynamics on Ground Deformation in Salar de Atacama Using PSI and Sentinel Imagery

J. Paziewski, R. Sieradzki, J. Koscielski, H. Szczepanik, D. Tomaszewski, K. Stepniak

Validation of mass-market GNSS and IMU MEMS sensors for millimeter-level displacement retrieval under simulated vibrations

R. Naeimaei, S. Schön

Deterministic Uncertainty for Terrestrial Laser Scanning Observations Based on Intervals

C. Ito, S. Nishiyama

UAV Measurement Methods for Monitoring of Volume Reduction at Dredged Sediment Disposal Sites

R. Palamà, A. Barra, M. Cuevas-González, K. Pawłuszek-Filipiak, J. Navarro, O. Monserrat, M. Crosetto

Wide-Area Supervised Classification of Ground Deformation Phenomena from European Ground Motion Service Products

G. Ferhat

Evaluation of several GNSS receivers: from low-cost to high-end geodetic receivers

Wednesday, 09.04.2025, 10:05 - 11:15, [Room A + Room C](#)

G. Ferhat, M. Ajrouche, C. Fontaine, L. Krangnes, M. Meroni

Some examples of landslide monitoring using Trimble equipment in Europe

A. M. Ruiz-Armenteros, M. Marchamalo-Sacristán, F. Lamas-Fernández, Á. Hernández-Cabezudo, A. Fernández-Landa, J. M. Delgado-Blasco, M. Bakon, M. Lazecky, D. Perissin, J. Papco, G. Corral, J. L. Mesa-Mingorance, J. L. García-Balboa, A. Da Penha Pacheco, J. M. Jurado-Rodríguez, J. J. Sousa

Integrated Monitoring of Dams and Large Ponds: The Role of Satellite Radar Interferometry and the European Ground Motion Service

L. Hu, X. Meng, X. An, Y. Xie, C. Hancock, Y. Bao

A New Method for Discriminating and Mitigating GNSS Multipath Errors in Bridge Structure Health Monitoring

J. Li, X. Meng, L. Hu, Y. Bao, S. Zhao

A New Method for Intelligent Bridge Crack Identification and Measurement through Integrating YOLOv8 and U-Net3+

J. Kapłan, A. Kaczmarek, I. Kudłacik, H. Romanik, Z. Zięba

The evaluation of high-rate displacements' detection using Septentrio mosaic X5 low-cost GNSS receiver supported with external clock signal

Y. Dai, W. Dai

Automated Stability Assessment Framework for Rock Slopes Driven by Deformation Monitoring Data and Physical-Mechanical Model

D. Pan, W. Dai, L. Xing, Y. Zhang

Scheimpflug Camera-Based Deformation Monitoring Technology and Applications

S. Benyahia, B. Rouissat, N. Smail, F. Touati, N. Benaraba

Monitoring of an embankment dam in northwestern Algeria based on Sentinel-1 Time-series InSAR

Z. Muszynski, M. Wyjadłowski, P. Kujawa, K. Gorska

Application of terrestrial laser scanning and inclinometer for comprehensive monitoring of deep excavation

Q. Zhang, Z. Wu, D. Zhao, B. Chen

Time-aware TCN-LSTM-based approach for the early warning of temperature-induced bearing displacement of suspension bridges

J. E. Blanco, M. C. DeLacy, M. A. Gomez

Bayesian and frequentist significance of vertical displacements from high-precision geodetic observations: case study in an earth fill dam placed in southern Spain

A. Dali, R. D. Garg

Analysing Multi-Temporal Change Detection With Remotely Sensed Imagery Using Google Earth Engine Cloud Platform: A Case Study Of Syria
