



LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

Programme measuring the changes



13th FIG Symposium on Deformation
Measurement and Analysis



4th IAG Symposium on Geodesy for Geotechnical
and Structural Engineering

LNEC • LISBON • PORTUGAL • 2008 May 12-15

Monday

May 12,

09:00-10:30

PLENARY SESSION - Opening Ceremony & keynote speeches

ACTIVITY OF THE FIG WORKING GROUP 6.1 ON DEFORMATION
MEASUREMENTS – PROGRESS REPORT 2006-2008

Chrzanowski & C. Whitaker

GEODESY & ENGINEERING –DEFORMATION STUDIES AT LARGE SCALES
FROM A GEODETIC VIEWPOINT

C. Rizos

15:30-16:00

COFFEE BREAK

11:00-12:30

PARALLEL SESSION (Room #1) - Multitechniques (MTT)

Chair: Stathis Stiros

DEFORMATION MONITORING THROUGH MULTI-PLATFORM INTEGRATION

E. Davis et al.

DESIGN AND ANALYSIS OF MULTI-SENSOR DEFORMATION DETECTION
SYSTEMS

Szostak-Chrzanowski et al.

COMBINED TECHNIQUES FOR THE STABILITY CONTROL OF HISTORICAL
STRUCTURES

A. Guarnieri et al.

DAM MONITORING USING COMBINED TERRESTRIAL IMAGING SYSTEMS

J. Boavida et al.

POINT ATTITUDE DETERMINATION USING INCLINOMETER AND GPS FOR
HIGH RISE BUILDING MONITOR-ING PROJECTS

J. Van Cranenbroeck et al.

11:00-12:30

**PARALLEL SESSION (Room #2) - Engineering geodesy for
multi-technique local survey ties**

Chair: João Agria Torres

IMPORTANCE OF LOCAL TIES FOR THE ITRF

Z. Altamimi

Programme

CHALLENGES OF INTER-TECHNIQUE TIE SURVEYS – AN ENGINEERING PERSPECTIVE

H. Kutterer et al.

INDIRECT DETERMINATION OF THE INVARIANT REFERENCE POINT (IVP) OF SLR AND VLBI OBSERVING SYSTEMS

A. Woods

TERRESTRIAL SURVEYING APPLIED TO LARGE VLBI TELESCOPES AND ECCENTRICITY VECTORS MONITORING

P. Sarti et al.

12:30-14:00 LUNCH

14:00-15:30 **PARALLEL SESSION (Room #1) - Modelling (MOD1)**

Chair: Alojz Kopáček

AN EVALUATION OF METHODS FOR THE IDENTIFICATION OF VARIANCE CHANGES IN DEFORMATION ANALYSIS

H. Neuner

AUTOMATED ANALYSIS AND EVALUATION OF TECHNICAL SURVEYING PROCESSES WITH KNOWLEDGE-BASED SYSTEMS

A. Eichhorn et al.

BAYESIAN ESTIMATION IN DAM MONITORING NETWORKS

J. Casaca et al.

COMPARISON OF MONTE CARLO AND FUZZY TECHNIQUES IN UNCERTAINTY MODELLING

I. Neumann et al.

14:00-15:30 **PARALLEL SESSION (Room #2) - GNSS (GNSS1)**

Chair: Chris Rizos

COMPARATIVE TESTING AND ANALYSIS OF RTS VERSUS GPS FOR STRUCTURAL MONITORING USING CALIBRATION MEASUREMENTS UPON SINUSOIDAL EXCITATION

V. Gikas & S. Daskalakis

STRUCTURAL DEFORMATION MONITORING ANALYSIS USING GEODETIC TECHNIQUES AFTER THE EARTHQUAKE AT BOLU PASS OF TRANSPORT EUROPEAN MOTORWAY

E. Tekdal et al.

DEVELOPMENTS TOWARDS A LOW-COST GNSS BASED SENSOR NETWORK
FOR THE MONITORING OF LANDSLIDES

J. Günther et al.

ANALYSIS OF DEFORMATIONS IN THE AUSTRIAN REFERENCE NETWORK

M. Haberler-Weber & R. Weber

NAVD88 ORTHOMETRIC HEIGHT DETERMINATION UTILIZING THE
CALIFORNIA REAL TIME GPS NETWORK AND VARIED OCCUPATION TIME
INTERVALS

C. Whitaker et al.

15:30-16:00 COFFEE BREAK

16:00-17:30 **PLENARY SESSION - Equipment (EQP1)**

Chair: João Casaca

OVERVIEW OF FIBRE OPTIC SENSING APPLICATIONS TO STRUCTURAL
HEALTH MONITORING

D. Inaudi & B. Glisic

AUSCULTATION AND MONITORING IN REAL TIME

C. Fonfria et al.

3-DEMON MONITORING PLATFORM: EXAMPLES OF APPLICATIONS IN
STRUCTURAL AND GEOTECHNICAL MONITORING PROJECTS

L. Manetti et al.

GAMMA'S PORTABLE RADAR INTERFEROMETER

C. Werner et al.

17:30-19:00 **Tools for Measuring the Changes : the Exhibitor's session**

19:00 **Ice Breaker Party**

Programme

09:00-10:30

PARALLEL SESSION (Room #1) - Monitoring of structures (MST1)*Chair: Antonio Gil*

TOPOGRAPHIC MONITORING OF A WATER TANK IN THE WIDENING
WORKS OF EIXO NORTE-SUL HIGHWAY IN LISBON

J. Henriques & A.P. Falcão

MONITORING PLANIMETRIC DISPLACEMENTS IN CONCRETE DAMS

A. Tavares de Castro & M. J. Henriques

COMPARISON BETWEEN GEODETIC TECHNOLOGY AND PLUMB LINES IN
MONITORING OF DISPLACEMENTS ON ITAIPU DAM

F. Ribeiro et al.

MONITORING AND DEFORMATION ASPECTS OF LARGE CONCRETE FACE
ROCKFILL DAMS

A. Szostak-Chrzanowski et al.

09:00-10:30

PARALLEL SESSION (Room #2) - Geodeformations (GDF1)*Chair: Manuela Vasconcelos*

MONITORING AND DEFORMATION ANALYSIS OF ROCK BLOCKS

S. Cacoń & B. Kontry

DETECTION OF LANDSLIDE PRONE AREAS ON THE BASIS OF GEOLOGICAL,
GEOMORPHOLOGICAL INVESTIGATIONS, A CASE STUDY

G. Újvári et al.

USE OF GEOID, LEVELING AND GPS FOR VERTICAL DEFORMATION
MONITORING

J. Catalao et al.

15:30-16:00

COFFEE BREAK

11:00-12:30

PARALLEL SESSION (Room #1) - Modelling (MOD2)*Chair: Maria João Henriques*

DERIVATION OF ENGINEERING-RELEVANT DEFORMATION PARAMETERS
FROM REPEATED SURVEYS OF SURFACE-LIKE CONSTRUCTIONS

A. Dermanis

AN INNOVATIVE MATHEMATICAL SOLUTION FOR A TIME-EFFICIENT IVS
REFERENCE POINT DETERMINATION

M. Lösler & M. Hennes

PRACTICAL ADVANTAGES OF USING THE MECHANICS OF CONTINUUM TO
ANALYSE DE-FORMATIONS OBTAINED FROM GEODETIC SURVEY

M. Talich

INVESTIGATION OF DYNAMIC THERMAL EFFECTS WITH NON-PARAMETRIC
AND PARAMET-RIC DEFORMATION MODELS

A. Eichhorn et al.

11:00-12:30 PARALLEL SESSION (Room #2) - Geodeformations (GDF2)

Chair: Rui Fernandes

INVESTIGATION OF DIFFERENT POSSIBLE AGENCIES CAUSING LAND-
SLIDES ON THE HIGH LOESS BANK OF THE RIVER DANUBE AT DUNAFÖLD-
VÁR, HUNGARY

G. Mentés

MONITORING OF A LARGE SLIDE AND SLOPE RECLAMATION IN A FORMER
OPEN-PIT MINE

M. Zalesky et al.

QUANTITATIVE ASSESSMENT ON THE INFLUENCE OF RAINFALL ON
KUTLUGUN LANDSLIDE

T. Bayrak

DEFORMATION MONITORING AT AN INDUSTRIAL SITE USING COMBINED
DGPS AND TOTAL STATION DATA

A. Ebeling et al.

12:30-14:00 LUNCH

14:00-15:30 PARALLEL SESSION (Room #1) - Radar (RDR1)

Chair: Xiaoli Ding

SUBSIDENCE AND UPLIFT AT WASSENBERG, GERMANY DUE TO COAL
MINING USING PER-SISTENT SCATTERER INTERFEROMETRY

M. Caro Cuenca & R. Hanssen

PS-INSAR MEASUREMENT OF GROUND SUBSIDENCE IN GRANADA AREA
(BETIC CORDIL-LERA, SPAIN)

J. Sousa et al.

PSINSAR DETECTION OF GROUND MOTION IN THE LISBON REGION

S. Heleno et al.

USING SMALL BASELINE INTERFEROMETRIC SAR TO MAP NONLINEAR
GROUND MOTION IN NORTHERN TIBET

Z. Li et al.

14:00-15:30

**PARALLEL SESSION (Room #2) - Monitoring of structures
(MST2)**

Chair: Wolfgang Niemeier

CONTRIBUTION OF THE APPLIED GEODESY TO THE PREVENTION OF
ACCIDENTS AND TO THE REHABILITATION OF FILL STRUCTURES

A. Veiga Pinto & M. Henriques

HORIZONTAL DEFLECTION ANALYSIS OF A LARGE EARTHEN DAM BY
MEANS OF GEODETIC AND GEOTECHNICAL METHODS

V. Gikas & S. Sakelariou

DAM CREST SETTLEMENT, RESERVOIR LEVEL FLUCTUATIONS AND
RAINFALL: EVIDENCE FOR A CAUSATIVE RELATIONSHIP FOR THE KREMASTA
DAM GREECE

S. Pytharouli & S. Stiros

15:30-16:00

COFFEE BREAK

16:00-16:30

Poster Session (PST1) (Hall)

SLOPE STABILITY MONITORING USING SPACE-BORNE REPEAT-PASS SAR
INTERFEROMETRY

U. Wegmüller et al.

GPS/INS/PL/TLS INTEGRATION SUPPORTING NAVIGATION OF
GEOPHYSICAL SENSORS FOR UNEXPLODED ORDNANCE DETECTION AND
DISCRIMINATION

D. Grejner-Brzezinska et al.

MEASURED SETTLEMENTS OF THE PESNICA HIGH EMBANKMENT

P. Zvanut

FOUR DIMENSIONAL MONITORING OF DEFORMATION AS DEDUCED
FROM REPEATED GPS CAMPAIGNS

Y. Fujii & Y. Shinde

DAM DEFORMATION ANALYSIS USING THE PARTIAL LEAST-SQUARES METHOD

N. Deng et al.

MONITORING STATIC DEFORMATION OF THE BULK DAM IN THE EAST SLOVAKIA

V. Sedlak et al.

STUDY OF LAND SUBSIDENCE AND GROUND FISSURE ACTIVITIES IN XI'AN CITY WITH INSAR

C. Zhao et al.

GPS NETWORK FOR LOCAL DEFORMATION MONITORING IN THE ATLAS MOUNTAINS OF MOROCCO

A. Gil et al.

STABILITY OF HISTORICAL BUILDINGS

J. Zalesky, et al.

MONITORING THE DEFLECTIONS OF LARGE SUSPENSION BRIDGES IN THE UK BY GPS

G. Roberts et al.

CONCEPT FOR RISK ASSESSMENT AND MONITORING OF THE UPPER BIO BIO REGION IN CENTRAL CHILE STRUCTURES

W. Niemeier & B. Riedel

STUDY OF A LONG-TERM BEHAVIOR OF LARGE EARTH DAM COMBINING MONITORING AND FINITE ELEMENT ANALYSIS RESULTS

A. Szostak-Chrzanowski et al.

GEODETIC MONITORING OF THE THERA (SANTORINI) CALDERA

S. Stiros et al.

HORIZONTAL MOVEMENTS OF THE TECTONIC UNITS OF EUROPE BASED ON DATA OF EPN SERVICE

B. Kontry & R. Bednarek

AN INTEGRATED MONITORING SYSTEM FOR THE MONUMENTAL WALLS OF AMELIA

D. Dominici et al.

16:30-18:00

PLENARY SESSION - Radar (RDR2)

Chair: Dorota Grejner-Brzezinska

RECOVERY OF SENSOR PLATFORM TRAJECTORY FROM LIDAR DATA USING
REFERENCE SURFACES

C. Toth et al.

STRUCTURAL DEFORMATION OF THE HIGH-SPEED LINE (HSL)
INFRASTRUCTURE IN THE NETHERLANDS; OBSERVATIONS USING SATELLITE
RADAR INTERFEROMETRY

M. Arikan & R. Hanssen

EXPERIMENTAL STUDIES ON MONITORING GROUND DEFORMATIONS
WITH CORNER RE-FLECTOR INSAR

X. Ding et al.

MONITORING DEFORMATION OF WATER DEFENSE STRUCTURES USING
SATELLITE RADAR INTERFEROMETRY

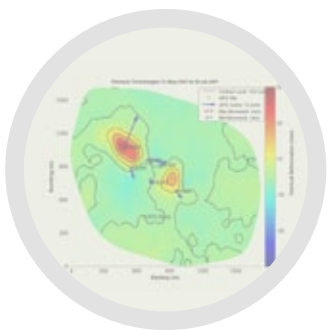
R. Hanssen & F. Van Leijen

MEASURING DEFORMATION AND TOPOGRAPHY WITH A PORTABLE RADAR
INTERFEROMETER

A. Wiesmann et al.

18:00

Social Dinner



09:00-10:30

PARALLEL SESSION (Room #1) - Modelling (MOD3)

Chair: Witold Prószyński

EXTRACTION OF DEFORMATION SIGNALS OF A SLOPE WITH KALMAN
FILTERING TECHNIQUE

X. He et al.

OPTIMAL DESIGN OF DEFORMATION MONITORING NETWORKS BY USING
PSO ALGORITHM

M. Yetkin et al.

SMOOTHING GNSS TIME SERIES WITH ASYMMETRIC MOVING AVERAGES

J. Lima & J. Casaca

PROCESSING METHODOLOGY FOR THE COMPUTATION OF AFREF
SOLUTIONS

R. Fernandes et al.

GNSS RTK NOISE REDUCTION IN POSITION DOMAIN USING CAUSAL
FIR FILTERING FOR GEOTECHNICAL AND STRUCTURAL ENGINEERING
APPLICATIONS

J. Van Cranenbroeck

09:00-10:30

**PARALLEL SESSION (Room #2) - Monitoring of structures
(MST3)**

Chair: Gethin Roberts

MODELLING THE BEHAVIOUR OF A LARGE SPAN GLULAM ARCH OF
ATLÂNTICO PAVILLION

M. J. Henriques et al.

EVALUATION OF THE CONVENTIONAL SURVEYING EQUIPMENT APPLIED
TO DEFORMATION ANALYSIS OF HERITAGE BUILDINGS. A CASE STUDY: THE
TOWER OF SANTA MARÍA LA BLANCA CHURCH IN AGONCILLO (LA RIOJA,
SPAIN)

J. Valle Melon et al.

ESTIMATION OF THE VERTICAL DEFORMATIONS OF THE STYLOBATE OF
ANCIENT TEMPLES – THE CASE OF THESEION

G. Georgopoulos & E. Telioni

MONITORING OF TALL BUILDING'S DYNAMIC BEHAVIOUR USING
PRECISION INCLINATION SENSORS

C. Yigit et al.

METROPOLITANO DE LISBOA - TERREIRO DO PAÇO TUNNEL: EXTENSION
OF THE BLUE LINE LISBON UNDERGROUND; GEODETIC MONITORING OF
AN ACCIDENT SITE

A. Mesquita Machado

DETERMINING DISPLACEMENTS ON TUNNEL BY GEODETIC AND 3D FINITE
ELEMENT METH-ODS

M. Yalçinkaya et al.

10:30-11:00 **COFFEE BREAK**

11:00-12:30 **PARALLEL SESSION (Room #1) - Laserscanning (LSS)**

Chair: Adam Chrzanowski

CHECKING OF CRANE RAILS BY TERRESTRIAL LASER SCANNING
TECHNOLOGY

T. Kremen et al.

MONITORING OF LOCK CHAMBER DYNAMIC DEFORMATION

B. Koska et al.

USE OF A POINT CLOUD CO-REGISTRATION ALGORITHM FOR
DEFORMATION MEASURING

O. Monserrat et al.

DEFORMATION MONITORING BASED ON TERRESTRIAL LASER SCANNER
POINT CLOUD REGISTRATION

L. Tournas & M. Tsakiri

DEFORMATION ANALYSIS WITH 3D LASER SCANNING

F. Gielsdorf et al.

11:00-12:30 **PARALLEL SESSION (Room #2) - GNSS (GNSS2)**

Chair: Luísa Bastos

IDENTIFICATION OF MULTIPLE OSCILLATION FREQUENCIES WITH GPS,
BASED ON EXPERIMENTAL EVIDENCE AND ANALYSIS IN THE FREQUENCY
AND THE TIME DOMAIN

P. Psimoulis et al.

DETECTION OF DEFORMATIONS AND OUTLIERS IN REAL-TIME GPS
MEASUREMENTS BY KALMAN FILTER MODEL WITH SHAPING FILTER

L. Li & H. Kuhlmann

MONITORING THE DEFORMATIONS OF A MOTORWAY VIADUCT USING
KINEMATIC GPS

G. Roberts et al.

HOW FAR COULD GPS GO IN MONITORING STRUCTURAL RESPONSE TO
WIND EVENTS?

C. Rizos et al.

12:30-14:00 LUNCH

14:00-15:30 **PARALLEL SESSION (Room #1) - Equipment (EQP2)**

Chair: Nuno Lima

DEFORMATION MONITORING USING A NEW KIND OF OPTICAL 3D
MEASUREMENT SYSTEM: COMPONENTS AND PERSPECTIVES

A. Reiterer et al.

MONITORING A DEEP-SEATED MASS MOVEMENT USING A LARGE STRAIN
ROSETTE

H. Woschitz & F. Brunner

FUSION OF GEODETIC AND MEMS SENSORS IN INTEGRATED
MONITORING AND ANALYSIS OF DEFORMATIONS

L. Danisch et al.

NEW DIGITAL CRACK-MONITORING SYSTEM FOR OBJECTIVE
DOCUMENTATION OF THE WIDTH OF CRACKS IN CONCRETE STRUCTURES

W. Niemeier et al.

14:00-15:30 **PARALLEL SESSION (Room #2) - Modelling (MOD4)**

Chair: Gyula Mentés

THE CONCEPT OF NETWORK ROBUSTNESS BASED ON STRAIN ANALOGY
AS SEEN IN THE LIGHT OF CONTINUUM MECHANICS

W. Gambin et al.

SPLIT ESTIMATION OF PARAMETERS IN FUNCTIONAL GEODETIC MODELS

Z. Wisniewski

GEODETIC APPLICATION OF R-ESTIMATION: LEVELLING NETWORK
EXAMPLES

R. Duchnowski

COMPARING A UNIVARIATE TIME SERIES APPROACH WITH NEURAL
NETWORKS TO PRE-DICT DEFORMATION OF SOIL MASS

G. Bourmas & M. Tsakiri

15:30-16:00 COFFEE BREAK

16:00-16:30 **Poster Session (PST2) (Hall)**

THE CONCEPTION OF MONITORING THE SUPERFICIAL DEFORMATION
LOCATED ON THE UNSTABLE FOUNDATION WITH THE USAGE OF GPS
TECHNOLOGY

W. Kamiński

GROUND RUPTURES AND SEISMIC FAULTING AT DEPTH: THE CASE OF THE
KALAMATA, GREECE, 1986 EARTHQUAKES

S. Stiros et al.

INTRODUCTION AND ANALYSIS OF COMMONLY USED NON-PARAMETRIC
MODELS OF DAM DEFORMATION IN CHINA

N. Deng et al.

SPECIAL MARKING OF 3D NETWORKS' POINTS FOR THE MONITORING OF
MODERN CON-STRUCTIONS

E. Lambrou et al.

APPLICATION OF DEFORMATION ANALYSIS AND ITS NEW POSSIBILITIES

M. Talich & J. Havrlant

REDUCTION OF THE DIMENSIONALITY OF HYPERSPECTRAL DATA FOR THE
CLASSIFICA-TION OF AGRICULTURAL SCENES

C. Silva et al.

DEEP, SUB-SURFACE DEFORMATION MEASUREMENTS OBTAINED USING
COMBINED GE-OMECHANICAL MODELING AND INVERSION TECHNIQUES
WITH SURFACE MICRO DEFORMA-TION MEASUREMENTS

W. Roadarmel et al.

SOFTWARE TO OPTIMIZE SURVEYING NETWORKS

A. Silva et al.

A WEB-BASED SYSTEM FOR DEFORMATION MONITORING

B. Teskey et al.

ARTIFICIAL INTELLIGENCE METHODS IN DEFORMATION ANALYSIS

P. Grzempowski & S. Cacon

TESTING: AN APPLICATION FOR MOTORIZED TACHEOMETERS

P. Mateus

ESTABLISHMENT OF THE GHANA'S GEODETIC REFERENCE NETWORK

Y. Poku-Gyamfi & T. Schüler

LOW COST MOBILE MAPPING SYSTEM FOR URBAN SURVEYS

S. Madeira et al.

REAL TIME AND POST-PROCESSING MONITORING SOLUTIONS WITH THE
NEW LEICA GMX901 L1 GPS RECEIVER

J. Van Cranenbroeck & I. Bennewith

USE OF GPS BASED DRIFTERS IN THE STUDY OF COASTAL CURRENTS

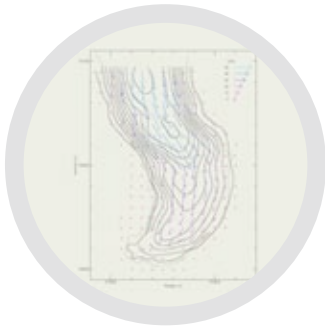
L. Bastos & J. Silva

16:30-17:00

Closing Ceremony

17:00-18:00

Meeting of the Working Group 6.4 Task Force 5 Fibre Optic
Sensors (Room #2)



Programme

08:00-20:00 TECHNICAL VISIT (Alqueva and Álamos Dams)



Alqueva Dam



Álamos Dam