Final Program

9th European Conference on Synthetic Aperture Radar

EUSAR 2012

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■ 23 - 26 April 2012
■ CCN Ost, Nürnberg, Germany

Organized by

ITG/VDE

CASSIDIAN Fraunhofer FHR ASTRIUM DLR

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EUSAR 2012

9th European Conference on Synthetic Aperture Radar

April 23 - 26, 2012, Nürnberg, Germany

EUSAR is jointly organised by:

ITG (VDE) Information Technology Society of VDE

CASSIDIAN an EADS Company

Fraunhofer FHR Fraunhofer Institute for High Frequency Physics and Radar Techniques

Astrium an EADS Company

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Welcome Message from the General Chairman

It is a great pleasure for me to welcome you to the EUSAR 2012 conference in Nürnberg (Nuremberg) in southern Germany.
This year´s EUSAR 2012, the European Conference on Synthetic Aperture Radar, is the 9th conference in a two-year series since the beginning in 1996. Over the years, the EUSAR has been growing to a symposium with currently almost 500 participants and is recognized as the world's leading international conference dedicated to SAR techniques, technology, and applications.

Not only did the number of proposed EUSAR papers and posters increase in the years, but also the number of participating nations. We expect to welcome representatives from more than 30 nations to EUSAR 2012. It is the open spirit of this conference that supports the worldwide discussion of experts on scientific, ecological, commercial, and security related topics. This is important, since the heart of our interest is in remote sensing with Radar which, in many cases, is of common interest around the globe.

Nürnberg is well known from the medieval ages as one of the most important German towns and the home of great artists, like the famous painter Albrecht Dürer.
You should not miss a walk through the heart of this charming town, where you can meet history at every corner.
However, Nürnberg is also a metropolis with high tech industry in the vicinity and a modern fair and conference centre with excellent public infrastructure, where this year's EUSAR is taking place.

I am looking forward to meeting you in Nürnberg during EUSAR 2012.

Rudolf Zahn
EUSAR 2012 General Chairman
CASSIDIAN, DE

Message from the Technical Chairman

On behalf of the program board I would like to welcome you to the 9th European Conference on Synthetic Aperture Radar (EUSAR 2012) conference!

The overwhelming response to our call-for-papers indicates the popularity of this conference and confirms that EUSAR has become the world-wide forum for all aspects of science and technology in the field of SAR related topics. The enthusiasm has certainly increased due to the successful launches of the latest SAR Missions and the excellent status of future programs. For EUSAR 2012, we have received contributions from more than 30 countries all over the world. After the review process, nearly 200 papers were selected for oral presentation and 90 papers will be displayed for interactive poster presentations. Thanks to this response, all important fields of SAR techniques, technology and exploitation are covered by the contributions. To our pleasure several invited sessions has been organised and there will be for the second time two special sessions on "Comparison of SAR, SAS, Sonography", which opens the mind of the researchers beyond one's own field by looking into complementary fields.

Prior to the EUSAR conference there is a tutorial day with four parallel courses. The conference itself starts with the plenary session on Tuesday, where keynote speeches will be given by distinguished experts. Throughout the remaining three conference days four parallel oral sessions will be held in separate halls. We have arranged the parallel sessions in a manner that overlap of related research areas is kept to a minimum. As it is a traditional the first conference day will be closed by a piano recital and a reception in the "Bratwurst Röslein" (downtown of Nürnberg). Posters will be displayed throughout the three conference days. Special attention should be given to the interactive poster presentation on Wednesday evening.

A Best Paper Award, a Best Poster Award and three Student Best Paper Awards will be awarded at the closing session on the last day of the conference. Finally, I would like to invite you to join the technical tour to SIEMENS Healthcare Sector, Erlangen and Forchheim on Friday, which provides you with a close-up view of world-class research in the areas of image generation and processing in the health sector, for instance.

I would like to express my thanks to all authors for their outstanding contributions and in particular the members of the program board for their competent evaluation of the large number of submissions. Likewise I would also like to express my appreciation to the program and awards committee, as well as to the invited chairs for their careful preparation of the invited sessions.

I am looking forward to seeing you in Nürnberg.

Matthias Weiß

Technical Chair & EUSAR-Executive
Fraunhofer FHR, DE

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Conference Schedule

Monday, April 23, 2012

08:00 - 18:00	Registration
09:00 - 17:30	Tutorials
10:30 - 11:00	Coffee Break
12:30 - 14:00	Lunch Break
15:30 - 16:00	Coffee Break

Tuesday, April 24, 2012

08:00 - 18:00	Registration
09:30 - 18:00	Exhibition
09:00 - 10:10	Welcome and Keynotes
10:10 - 10:40	Coffee Break
10:40 - 12:20	Oral Sessions
12:20 - 13:30	Lunch Break
13:30 - 15:10	Oral Sessions
15:10 - 15:40	Coffee Break
15:40 - 17:00	Oral Sessions
17:15 - 18:00	Social Program (Piano Recital by the BONUM Piano Duet)
18:45 - 22:00	Get together (Bratwurst Röslein)

Wednesday, April 25, 2012

08:00 - 18:00	Registration
08:30 - 18:00	Exhibition
08:30 - 10:10	Oral Sessions
10:10 - 10:40	Coffee Break
10:40 - 12:20	Oral Sessions
12:20 - 13:40	Lunch Break
13:40 - 15:20	Oral Sessions
15:20 - 15:50	Coffee Break
15:50 - 18:00	Oral Sessions
18:00 - 19:00	Poster Session (Exhibition Area)
19:00 - 22:00	Poster Session (music happening and drinks + snacks)

Thursday, April 26, 2012

08:00 - 16:00	Registration
08:30 - 16:00	Exhibition
08:30 - 10:10	Oral Sessions
10:10 - 10:40	Coffee Break
10:40 - 12:20	Oral Sessions
12:20 - 13:40	Lunch Break
13:40 - 15:20	Oral Sessions
15:20 - 16:00	Awards Presentation and Closing Remarks

EUSAR 2012 Program Overview

Monday, April 23, 2012

Time	Krakau — T1: Advanced multidimensional SAR and MTI techniques	Prag — T2: Bi-/multistatic SAR	Budapest — T3: Polarimetry / Pol-InSAR Advanced Image Exploitation	Riga — T4: SAR Exploitation in an operational environment
09:00	Introduction into SAR Interferometry and Tomography	Introduction into distributed SAR/ISAR	SAR polarimetry	Professional SAR Data Processing
10:30	Coffee Break (will be served in the Foyer St. Petersburg)			
11:00	Multidimensional SAR imaging	Image formation algorithms	Application of Pol and Pol-InSAR	Operational Monitoring and SAR Applications with TerraSAR-X
12:30	Lunch Break (will be served in the Foyer St. Petersburg)			
14:00	Airborne multi-channel SAR/MTI	Experimental aspects of bistatic SAR/ISAR	SAR image exploitation	Rapid Mapping and operational monitoring exploiting the capabilities of the COSMO Skymed Constellation
15:30	Coffee Break (will be served in the Foyer St. Petersburg)			
16:00	Space-based SAR/MTI techniques	Multistatic ISAR	Advanced image interpretation	Forest Mapping using SAR and SAR Processing in GIS workflows
17:30	Discussion / End of Tutorial			

Tuesday, April 24, 2012

Time	St. Petersburg	Shanghai	Seoul	Istanbul	Kiew
09:00	Welcome				
09:10	Keynotes				
10:00	Introduction to EUSAR 2012				
10:10	Coffee Break (will be served in the exhibition area)				
10:40		Session A.1: Digital Beamforming SAR (invited)	Session B.1: Urban Remote Sensing I (invited)	Session C.1: SAR/SAS/Sonography I (invited)	Session D.1: Calibration and Modelling
12:20	Lunch Break (will be served in the exhibition area)				
13:30		Session A.2: SAR Technology	Session B.2: Urban Remote Sensing II (invited)	Session C.2: SAR/SAS/Sonography II (invited)	Session D.2: Calibration and Verification
15:10	Coffee Break (will be served in the exhibition area)				
15:40		Session A.3: Next Generation SAR and Future Missions	Session B.3: Urban Remote Sensing III	Session C.3: Innovative Wave Forms, non-Classicals	Session D.3: Inverse and Circular SAR
17:15	Piano Recital by the BONUM Piano Duet				
18:45–22:00	Get Together (Bratwurst Röslein)				

Wednesday, April 25, 2012

Time	Shanghai	Seoul	Istanbul	Kiew
08:30	Session A.4: TanDEM-X Mission Status (invited)	Session B.4: Multidimensional SAR Imaging Techniques (invited)	Session C.4: Implementation of Multi-modal SAR Technology in Agriculture, Forestry & Aquaculture plus Natural Disaster Assessment in South, East & Pacific Asia	Session D.4: Target Detection via Image Analysis
10:10	Coffee Break (will be served in the exhibition area)			
10:40	Session A.5: TanDEM-X	Session B.5: SAR Tomography (invited)	Session C.5: Feature Extraction	Session D.5: Maritime, Sea Clutter
12:20	Lunch Break (will be served in the exhibition area)			
13:40	Session A.6: Sentinel-1 ESA's New European Radar Observatory (invited)	Session B.6: Interferometry, Repeatpath SAR, SAR Tomography I	Session C.6: Classification	Session D.6: STAP, SAR-MTI
15:20	Coffee Break (will be served in the exhibition area)			
15:50	Session A.7: Airborne and UAV-SAR	Session B.7: Interferometry, Repeatpath SAR, SAR Tomography II	Session C.7: Near Field SAR for Security and Non-Destructive Testing (invited)	Session D.7: SAR-MTI
18:00–22:00	Poster Session and music happening by H. Braun & R. Klemm (incl. drinks and snacks) (Foyer level 2 and exhibition area)			

Room: Budapest   **Level 2**

Tutorial 3:
Polarimetry / Pol-InSAR Advanced Image Exploitation

SAR polarimetry:

Radar scattering is inherently a vector process. Polarimetric synthetic aperture radar systems measure the full vector nature of the scattered waves, capturing all the possible information in the scattering process. This additional information can be used to quantitatively understand the scattering processes that produced the observed return. While originally demonstrated in the 1980s and 1990s with airborne systems and on two missions on the Space Shuttle in 1994, the launch of modern polarimetric SAR systems such as PALSAR and TerraSAR-X has led to renewed interest in the analysis of polarimetric SAR data.

This tutorial examines the use of polarimetric SAR data in earth observations. It starts with a basic introduction to polarimetric SAR measurements, including acquisition modes (full and compact polarimetry) and calibration. It then examines the power of polarimetric SAR data analysis through advanced polarimetric concepts such as polarization signatures, eigenvalue decompositions, alpha angles and entropy. It builds on these concepts to discuss in detail polarimetric scattering decompositions to learn more about the observed scattering. Finally, we discuss the measurement of soil moisture for both bare and vegetated surfaces. All concepts are discussed and illustrated with actual polarimetric SAR data.

Polarimetric SAR Interferometry:

Polarimetric SAR Interferometry (Pol-InSAR) is new SAR remote sensing discipline with unique and powerful applications related to the vertical structure of natural and man-made volume scatterers. The coherent combination of single- or multi-baseline interferograms acquired at different polarisations provides sensitivity to the vertical distribution of scattering processes and allows their characterisation by using the associated (volume) interferometric coherences. Pol-InSAR is today a well established technique that promises a break-through in solving essential radar remote sensing problems. Indeed, structural parameters of volume scatterers in the biosphere and cryosphere such as vegetation height, structure, biomass, snow depth, and ice layering are today critical inputs for ecological process modeling and enable monitoring and understanding of eco-system change.

The tutorial offers an introduction to the basic concepts and ideas building the theoretical framework of introducing and exploring polarization diversity in interferometric measurements.

Physical interpretation, 3d modeling approaches, signal processing techniques and inversion models are introduced and discussed. The application of the introduced concepts is demonstrated and discussed by means of experimental results obtained in the frame of dedicated Pol-InSAR airborne campaigns. Emphasis is given on performance aspects arising from different temporal and geometrical acquisition implementations. The role and choice of spatial and temporal baselines, and system frequency with respect to scattering and terrain characteristics is investigated. Critical system and geometry parameters affecting the performance of Pol-InSAR configurations are established and discussed. Finally, the role and implementation of Pol-InSAR techniques in the frame of actual and future spaceborne SAR missions is reviewed, the potential and limitations arising are discussed.

SAR image exploitation:

New synthetic aperture radar (SAR) sensors on satellites like TerrsSAR-X allow flexible mapping with a large coverage or a high resolution of about one meter. Leading-edge airborne SAR sensors provide spatial resolutions on the order of a decimetre. In such data, many features of urban objects can be identified, which were beyond the scope of radar remote sensing before. But, SAR images are often really difficult to be interpreted: the presence of speckle as well as of some distortion effects, like shadowing and layover, makes the analysis of this kind of image complex. The impact of high resolution SAR data on the analysis of urban scenes and typical SAR effects are discussed. Examples for the appearance of buildings and other man-made objects are given. The benefit of SAR-simulation is addressed and examples are shown. Finally, typical problems in SAR simulation are discussed.

Advanced image interpretation:

Synthetic aperture radar (SAR) has become a key remote sensing technique in the last decades because it works under nearly all weather conditions and is independent from natural illumination. These capabilities are excellent for the exploitation of time series. Incoherent and coherent change detection techniques can be applied because of the fact that SAR is a coherent measurement system allowing to detect changes in the order of the fraction of the wavelength (mm scale). One focus of the tutorial is on methods for object based change detection and change categorization. The exciting possibilities to use SAR data for an advances image interpretation are demonstrated and discussed. On the other hand SAR images are difficult to interpret for image analysts because of its imaging geometry, the long wavelength and the coherent imaging principle. A methods for a simple

feature extraction useful for an intuitive image interpretation based on physical properties of the data is introduced (CovAm-Coh-Analysis) and discussed. Seasonal changes of these features over nearly a year are discussed to get a deeper understanding of the nature of SAR images.

Schedule Tutorial 3:

09:00   SAR polarimetry
Jakob van Zyl (JPL/NASA, USA)

10:30   Coffee Break

11:00   Polarimetric SAR Interferometry
Kostas Papathanassiou (DLR, DE)

12:30   Lunch

14:00   SAR image exploitation
Uwe Stilla (TU Munich, DE)

15:30   Coffee Break

16:00   Advanced image interpretation
Karsten Schulz (Fraunhofer-ISOB, DE)

17:30   Discussion / End of Tutorial

Room: Riga   **Level 2**

Tutorial 4:
SAR Exploitation in an operational environment

Professional SAR Data Processing:

The use of Synthetic Aperture Radar (SAR) data has become increasingly popular in recent years, offering professionals in a wide array of industries a measurable, analytical approach to getting information about an area or object of interest. State-of-the-art methodology, applied to data acquired from recent SAR sensors, generate accurate and detailed products.

This tutorial gives an overview on the professional generation of SAR products from airborne and spaceborne SAR data. The following topics will be discussed:
- SAR basics, applications and the efficient generation of SAR data products
- Processing of SAR amplitude imagery from data import to classifications
- Generation of elevation models with Interferometry (InSAR)
- Displacement mapping with Diffential Interferometry (DInSAR)
- Deduction of mm scale deformation velocities with Persistent Scatterers (PS)
- Monitoring of small deformations with Small Baseline Subset (SPAS) techniques

Operational Monitoring and SAR Applications with TerraSAR-X

Monitoring surface change in a qualitative and quantitative way plays an important role for many applications, such as the monitoring of critical infrastructure or for assessing damages and impacts following after natural disasters. With the radar satellite TerraSAR-X, high resolution images can be acquired reliably and independently of weather conditions and illumination for any area of interest on the globe. The repeat-pass images with nearly identical acquisition parameters allow for a direct comparison of the image as well as the exploitation of interferometric information. The latter is useful to derive a more complex and quantitative picture of surface changes and activities.

The tutorial presents typical applications of TerraSAR-X imagery with emphasis on Change Detection and interferometric Surface Movement Monitoring. Both services represent established operational activities which are applied synergistically to ground-based measurements and to the evaluation of optical remote sensing data.

Room: Shanghai   **Level 3**

Session A.1: Digital Beamforming SAR (invited)

Chairs: Christian Fischer (EADS Astrium GmbH, DE),
Michael Ludwig (ESA/ESTEC, NL)

10:40   First results from an airborne Ka-band SAR using SweepSAR and digital beamforming
Gregory Sadowy (Jet Propulsion Laboratory, USA);
Hirad Ghaemi (Jet Propulsion Laboratory, USA);
Scott Hensley (Jet Propulsion Laboratory, USA)

11:00   Interferometric Ka-band SAR with DBF capability
Christoph H. Schaefer (EADS Astrium, DE); Paco López-Dekker (German Aerospace Center (DLR), DE)

11:20   Digital Beamforming and MIMO SAR: Review and New Concepts
Gerhard Krieger (DLR, DE); Marwan Younis (German Aerospace Center (DLR), DE); Sigurd Huber (DLR, DE); Federica Bordoni (German Aerospace Center (DLR), DE); Anton Patyuchenko (German Aerospace Center (DLR), DE); Junghyo Kim (German Aerospace Center (DLR) & Karlsruhe Institute of Technology, DE); Piotr Laskowski (DLR, DE); Michelangelo Villano (German Aerospace Center (DLR), DE); Tobias Rommel (DLR, DE); Paco López-Dekker (German Aerospace Center (DLR), DE); Alberto Moreira (German Aerospace Center - DLR, DE)

11:40   X-Band HRWS Demonstrator: Digital Beamforming Test Results
Christian Fischer (EADS Astrium GmbH, DE); Christoph Heer (Astrium GmbH, DE); Rolf Werninghaus (German Aerospace Center (DLR), DE)

12:00   Application of Hybrid   ctive Array Fed Mirror Antenna for Multimode Spaceborne S-waveband SAR
Leon B. Neronskiy (Joint-stock Company "Radio Engineering Corporation "VEGA", RU); Vladimir Verba (Joint-stock Company "Radio Engineering Corporation "VEGA", RU); Valentin Andrianov (JSC Radio Engineering Corporation VEGA, RU); Evgeny Babkov (Moscow Institute of Physics and Technology, RU); Victor Kurenkov (JSC Radio Engineering Corporation VEGA, RU); Vladimir Turuk (JSC Radio Engineering Corporation VEGA, RU)

12:20 - 13:30 Lunch

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Room: Seoul   **Level 3**

Session B.1: Urban Remote Sensing I (invited)

Chairs: Uwe Stilla (Technische Universitaet Muenchen, DE),
Fabio Dell'Acqua (University of Pavia, IT)

10:40   The Urban Footprint Processor - Concept and Implementation of a Processing Chain within the TanDEM-X Mission
Andreas Felbier (German Aerospace Center (DLR), DE); Thomas Esch (DLR, DE); Achim Roth (DLR, DE); Wieke Heldens (DLR, DE); Hannes Taubenböck (DLR, DE); Maximilian Schwinger (DLR, DE); Martin Huber (German Aerospace Center (DLR), DE); Andreas Müller (DLR, DE); Stefan Dech (DLR, DE)

11:00   GIS-driven Iterative Filtering Approach for Building Height Estimation from InSAR Data
Antje Thiele (Fraunhofer IOSB & Karlsruhe Institute of Technology (KIT), DE); Clémence Dubois (Karlsruhe Institute of Technology (KIT), DE); Erich Cadario (Fraunhofer IOSB, DE); Stefan Hinz (Karlsruhe Institute of Technology, DE)

11:20   The Potential of Commercial Satellite SAR Images for Revealing Pattern of Life
Dan Johan Weydahl (Norwegian Defence Research Establishment (FFI), NO)

11:40   Statistics on High Resolution urban polarimetric images: application to segmentation and classification
Nicolas Trouvé (ONERA, FR); Maxime Sangnier (ONERA, FR); Elise Colin Koeniguer (ONERA, FR)

12:00   Layover Separation in Airborne Single Pass Multi-baseline InSAR Data Based on Compressive Sensing
Michael Schmitt (Technische Universitaet Muenchen (TUM), DE); Uwe Stilla (Technische Universitaet Muenchen, DE)

12:20 - 13:30 Lunch

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Room: Shanghai　　　　　　　　**Level 3**

Session A.2: SAR Technology

Chairs: Martin Suess (ESA/ESTEC, NL), Stefan V. Baumgartner (German Aerospace Center (DLR), DE)

13:30　A flexible hardware architecture for real-time air-borne Wavenumber Domain SAR processing
Martin Pfitzner (Leibniz University Hannover, DE); Fabian Cholewa (Leibniz University Hannover, DE): Peter Pirsch (Leibniz University Hannover, DE); Holger Blume (Leibniz University Hannover, DE)

13:50　Verification of the GMES Sentinel-1 Antenna Model
Alexander Hees (EADS Astrium GmbH, DE); Bernhard Grafmueller (EADS Astrium GmbH, DE); Peter Koch (EADS Astrium GmbH, DE); Markus Huchler (EADS Astrium, DE); Renato Croci (Thales Alenia Space Italia, IT); Allan Østergaard (European Space Agency, NL)

14:10　New Technologies for CoReH2O Mission
Florence Hélière (European Space Agency ESTEC, NL); Chung-Chi Lin (European Space Agency/ESTEC, NL); Franco Fois (ESA/ESTEC, NL); Nicolas Gebert (European Space Agency & ESTEC, NL); Arnaud Lécuyot (ESA, NL); Kees Van't Klooster (European Space Agency, NL); Marinella Aloisio (European Space Agency (ESTEC), NL); Michael Kern (ESA, NL); Dirk Schüttemeyer (ESA/ESTEC, NL); Bjorn Rommen (Estec & European Space Agency, NL); Malcolm Davidson (ESA/ESTEC, NL)

14:30　Hardware Realization of a 2m x 1m Fully Electronic Real-Time mm-Wave Imaging System
Andreas Schiessl (Rohde & Schwarz, DE); Andreas Genghammer (Rohde & Schwarz, DE); Sherif Sayed Ahmed (Rohde & Schwarz GmbH & Co. KG, DE); Lorenz-Peter Schmidt (University of Erlangen-Nuremberg, DE)

14:50　Design of a Compact, Modular, Multi-Frequency Band, Multi-Mode, Multi-Channel Synthetic Aperture Radar
Matthew Edwards (ARTEMIS, Inc., USA); Evan C. Zaugg (ARTEMIS, Inc., USA)

Room: Seoul　　　　　　　　**Level 3**

Session B.2: Urban Remote Sensing II (invited)

Chairs: Fabio Dell'Acqua (University of Pavia, IT), Uwe Stilla (Technische Universitaet Muenchen, DE)

13:30　Urban seismic damage assessment from post-event only SAR: preliminary tests on Envisat ASAR data
Roberto Cossu (European Space Agency, ?); Fabio Dell'Acqua (University of Pavia, IT); Diego Aldo Polli (University of Pavia, IT); Giovanni Rogolino (University of Pavia, IT)

13:50　A new phase unwrapping processing chain for 3D reconstruction of urban areas
Aymen Shabou (Telecom ParisTech, FR); Florence Tupin (Télécom Paris, FR); Giampaolo Ferraioli (University of Naples Parthenope, IT); Fabio Baselice (Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), IT)

14:10　SAR Interferometry for Atmospheric Modeling and Risk Assessment in Urban Environment
Andreas Tack (Finnish Meteorological Institute, FI); Jaan Praks (Aalto University, FI); Pauli Sievinen (Aalto University, FI); Antti Hellsten (Finnish Meteorological Institute, FI)

14:30　Geometry-Based SAR Curvilinear Feature Selection for Damage Detection
Peter TB Brett (University of Surrey, UK); Raffaella Guida (University of Surrey, UK)

14:50　A new approach for three-dimensional building extraction in high-resolution monoscopic SAR imagery
Edouard Barthelet (Telecom Bretagne & Thales Communications & Security, FR); Grégoire Mercier (TELECOM Bretagne, FR); Léonard Denise (Thales Communications & Security, FR); Sébastien Reynaud (Thales Communications & Security, FR)

15:10 - 15:40　Coffee Break

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