



Pre-Conference Early Researcher Radar Training Workshop

Overview of Topics

U.R.S.I.
Landesausschuss in
Deutschland e.V.

Commission F

Chairman:

Prof. Dr. Madhu Chandra

The course will be designed
and presented by a
workshop committee.

Coordination:

Prof. Dr. Madhu Chandra
Chemnitz University of
Technology TUC, Chemnitz

Contact-Person, Organisation:

Dipl.-Ing. Patrick Tracksdorf
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Advisor:

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Speakers:

Dr.-Ing. Andreas Danklmayer
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Dr.-Ing. Tobias Rommel
Deutsches Zentrum für Luft-
und Raumfahrt DLR, Weßling

Dr.-Ing. Jörg Steinert
Deutscher Wetterdienst DWD,
Offenbach

Workshop's Strategy

The course strategy is to familiarise the participants with key radar fundamentals that will enable the participants to come to grips with the current and the emerging radar methods. The course should particularly appeal to scientists and engineers who use radar remote sensing data, especially in the management and monitoring of disasters. The course combines oral presentations with some purposed-defined hands-on exercises.

The workshop contents are spread over four sections:

I. Radar Fundamentals

Prof. Dr. Madhu Chandra, Chemnitz University of Technology, Chemnitz

II. Radar Antennas

Dr. Tobias Rommel, DLR, Weßling

III. Weather Radar Applications

Dipl.-Ing. Patrick Tracksdorf and Dr. Jörg Steinert, DWD, Offenbach

IV. Hands-on SAR Signal Processing

Dr. Andreas Danklmayer, FHR, Wachtberg

Workshop Schedule:

08:00 - 08:15: Welcome and Preamble

Prof. Dr. Madhu Chandra (TUC) and Patrick Tracksdorf (DWD)

08:15 - 09:45: Fundamentals of Remote Sensing radars #1

Prof. Dr. Madhu Chandra (TUC)

Contents:

Using the language of radar physics and the methodologies of radars in current use, the following areas will be covered.

- Electromagnetic interaction for radars remote sensing
- Examples from radar observation from Aerospace- and Ground-based Radars
- Polarimetric form of Radar equations in power, field, and voltage forms
- Polarimetric and Doppler modelling of radar signals
- 'Golden Rules' of Radar Remote Sensing based on Physics of Remote Sensing
- Range versus Doppler Dilemma: a fundamental dilemma

09:45 - 10:00: Short Break

10:00 - 11:00: Fundamentals of Remote Sensing radars #2

Prof. Dr. Madhu Chandra (TUC)

Contents:



- Physical Interpretation of Radar Echoes: I-Q signals and I-Q detection
- Radar Waveforms and their applications
- Range and Doppler resolution
- Range-Doppler Coupling: Ambiguity Functions

11:00 - 11:10: Short Break

11:10 - 12:30: Understanding Antennas for next generation radars

Dr. Tobias Rommel (DLR)

Contents:

This session covers the key fundamentals of modern radar antennas: from classical apertures and array structures to electronic beam steering and current DBF and MIMO architectures. It explains the most important systemic relationships, such as polarization, frequency diversity, and the technical trade-offs between the number of channels, aperture, SNR, and resolution. Finally, the presentation provides a concise overview of current research topics and demonstrates how innovative antenna concepts are shaping the performance of future radar and SAR systems.

12:30 - 13:30: Lunch Break

13:30 - 14:15: Weather Radar Applications #1: Deployment of Polarimetric Doppler Weather Radar at Deutscher Wetterdienst

Patrick Tracksdorf (DWD)

Contents:

Starting with a quick overview of the Deutscher Wetterdienst (DWD) and followed by a historical excursion concerning “Radar at the DWD”, this session will focus on the recording and use of polarimetric Doppler weather radar measurements at DWD.

14:15 - 15:00: Weather Radar Applications #2: Visualisation of Weather Radar Observations

Dr. Jörg Steinert (DWD)

Contents:

This lecture deals with the use of measurements from weather radar systems to assist weather forecasters in analysing recent weather situation especially due to precipitation rate and type. The focus is laid on the visualisation of radar products in an operational set up at a national weather service. Various weather cases are explained using examples.

15:00 - 15:15: Short Break

15:15 - 17:00: MATLAB-based Hands-on SAR Signal Processing

Dr. Andreas Danklmayer (FHR)

Contents:

The Hands-on Synthetic Aperture Radar Remote Sensing Exercise offers a comprehensive overview of SAR technology, covering the fundamentals and various applications in environmental monitoring. Participants will be taken through a tailored set of hands-on exercises in order to provide first-hand learning experience in SAR processing and thereby also generate practical skills in applying Fourier Methods in radar signal processing.

17:30: Close of Workshop

