

## Location

CCG-Center, Technologiepark Argelsrieder Feld 11,  
D-82234 Wessling-Oberpaffenhofen

A list of nearby accommodations, a description of the location and hints for travel will be mailed to the participants upon registration. Please make your own hotel accommodation.

## Fee

EUR 1.695,-

Please pay by non-cash means after receiving the invoice.

CCG is a non profit organisation, exempt from value-added tax.

Members of CCG receive a 10 % discount and students a 75 % discount when they present their student card. If several employees of a company / department register for the same seminar, each receives a 10 % discount. The discounts cannot be combined.

## Registration

Please write or call (up to 14 days before the seminar) to

Carl-Cranz-Gesellschaft e.V.; P.O. Box 11 12, D-82230 Wessling

Tel. +49 (0) 8153 / 88 11 98 -12, Fax -19, E-Mail: anmelden@ccg-ev.de

Internet: [www.ccg-ev.de](http://www.ccg-ev.de)

After receipt of registration, a confirmation letter will be sent.

## Further Information

For more information about our organization please do not hesitate to contact the CCG at Oberpaffenhofen at the phone number given above.

For more information on the content of the seminar please contact

Prof. Dr. rer. nat. Madhukar Chandra

Lehrstuhl für Hochfrequenztechnik und Photonik

Technische Universität Chemnitz, D-09126 Chemnitz

E-Mail: [madhu.chandra@etit.tu-chemnitz.de](mailto:madhu.chandra@etit.tu-chemnitz.de)

## Substitutions and Cancellations

Substitutions may be made at any time. Cancellation of an accepted registration made up to 7 days prior to the start of the seminar is subject to a EUR 25,- administrative fee. Participants canceling after that date are responsible for the entire seminar fee.

CCG reserves the right to cancel a course up to 10 days before the course's beginning in case of low number of participants or for other significant reasons. Furthermore, CCG reserves the right, against the announcement in the programme, to possibly replace at short notice a lecturer and also the lecturer's topic. Any claims for damages shall be excluded.

## Who Should Attend

The seminar should be of interest to people engaged in propagation channel modeling in telecommunications, navigation and earth observation. The participants will be, typically, from areas of communication industry, space systems, military, navigation, automotive, remote sensing and earth observation. The course will provide insight into diverse aspects of EM-wave propagation encountered in these fields and it should not only appeal to the newcomers but also to the practicing engineers. The seminar will stress a problem-solving approach for channel modeling of high frequency systems influenced by various propagation effects.

## Focus

The course will provide application based and problem-solving based knowledge for assessing the performance of wireless channels affected by propagation. Both the present day applications and the emerging technologies are covered. The treatment of channel modelling will span applications over a wide range of frequencies generally associated with systems of: Satellite, Terrestrial and Mobile Telecommunication Facilities • Earth Observation and Microwave Radar Remote Sensing • Navigation (e.g. GPS and Galileo) • Automotive Information Systems, and • Airborne and Aviation Safety Systems

The seminar includes a laboratory demonstration of measurements typical to the indoor mobile propagation scenario and CAD sessions on simulating the performance of SatCom systems and satellite links. The presenters, who are involved in the state of the art propagation modelling and research, will emphasize the problem solving approach in dealing with the subject matter. The course material will be tailored to provide knowledge that is required by the practicing system planners and propagation engineers.

## Lecturers

H. Brandt	Dipl.-Ing	DLR, Institut für Kommunikation und Navigation, Wessling
A. Hornbostel	Dr.-Ing.	
D. Giggenbach	Dr.-Ing.	
T. Jost	Dipl.-Ing.	
F. Rossetto	Dr.-Ing.	
M. Chandra	Prof. Dr. rer. nat.	TU-Chemnitz, Lehrstuhl für Hochfrequenztechnik und Photonik, Chemnitz
A. Danklmayer	Dr.-Ing.	DLR, Institut für Hochfrequenz- und Radartechnik, Wessling
Th. Kürner	Prof : Dr.-Ing.	TU Braunschweig, Institut für NT

## Language

English

Each attendant will be provided with detailed course material in English.

## Seminar SE 2.05

# Electromagnetic Wave Propagation: its Concepts and Current Applications

November 15 – 18, 2011

Oberpaffenhofen near Munich

## Scientific Coordination

Prof. Dr. rer. nat. Madhukar Chandra

Technische Universität Chemnitz

## Seminar Outline

**Tuesday, November 15, 2011**  
**10.15 – 16.30**

10.15 – 10.30	<b>Welcome, Organisation</b>
10.30 – 12.00 M. Chandra	<b>Propagation topics of current interest</b> With reference to current applications in communications, remote sensing and navigation, the pertinent EM-wave propagation topics are described. The scientific knowledge required by these topics is then explained with Examples from mobile and satellite communications, navigation and Earth observation.
13.00 – 14.30 M. Chandra	<b>Overview of key propagation effects and models</b> The propagation effects central to the current topics are reviewed with practice-relevant exercises. The topics covered include: polarisation, reflection, refraction, diffraction, scattering, random media, statistical methods and system dependence.
15.00 – 16.30 A. Hornbostel	<b>Understanding the current navigation systems (GPS and Galileo)</b> System components: space, ground and user segment; signal structures of GPS and Galileo, navigation services, principle function of navigation receivers, augmentation systems, error budgets, acquisition, code and carrier tracking, application requirements;
approx. 17.30	<b>Social Event</b> Guided tour through the city center of Munich (voluntary)

**Wednesday, November 16, 2011**  
**08.30 – 17.30**

08.30 – 10.00 M. Chandra	<b>Tropospheric propagation in satellite as well as terrestrial links, and remote sensing</b> Signal degradations due to tropospheric effects are explained with the help of computational examples. Link-Availability-Estimation due to attenuation and depolarisation caused by rain and clouds.
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10.30 – 12.00 T. Jost	<b>Indoor Propagation</b> Characterization of outdoor-to-indoor channel models, Wide- and narrowband effects, Influence of different building profiles, materials and receiver position, Mobile radio and Satellite-to-indoor channel for communications and positioning, Effects on positioning systems in indoor environments;
13.00 – 14.30 F. Rossetto	<b>Propagation Limitations in Data Transfer along Microwave Links in Satellite Communications</b> A short introduction to satellite communication systems is provided and examples for link budget calculations are explained. Suitable channel models for satellite communication systems are introduced and the implications on transmission performance are discussed. Examples for mitigation possibilities are given.
15.00 – 16.30 A. Hornbostel	<b>Evaluation and Treatment of Propagation Problem in Navigation Applications (GPS and Galileo)</b> Atmospheric effects: troposphere delay, ionosphere delay, correction models, scintillations, higher order effects, atmospheric research with GPS and Galileo; indoor propagation; urban canyons; vegetation; interference;
16.45 – 17.30 A. Danklmayer	<b>Propagation Distortions in SAR Applications</b> A short introduction to the basic SAR principle is provided followed by a discussion of the ionospheric and tropospheric influence on SAR imaging. Observed propagation distortions are given together with underlying physics and mitigation possibilities.

**Thursday, November 17, 2011**  
**08.30 – 16.30**

08.30 – 10.00 10.30 – 11.15 Th. Kürner	<b>Millimeter and THz Wave Propagation</b> Introduction to applications for wireless communication systems operating beyond 60 GHz; modeling and measurements of basic propagation phenomena; channel models for realistic application scenarios; influence of shadowing by human bodies
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11.15 – 12.00 Th. Kürner	<b>Project and Campaign Management</b> This talk gives an overview about practical issues relevant for the planning of measurement campaigns organized for the development, calibration and verification of propagation models.
13.00 – 14.30 Th. Kürner	<b>Propagation Aspects in Car-to-X and Intra-Car Communications</b> Challenges in channel modeling for car-to-X and intra-car communications; characterization by measurements; an integrated simulation environments; case studies;
15.00 – 16.30 D. Gigenbach	<b>Propagation Aspects of Data Transfer along Free Space Optical Links</b> An introduction into the topic of Mobile Optical Data Transfer for Space and Atmospheric Links is provided. Optical modulation formats, wavelengths, data rates, components, and system sensitivities are discussed. Atmospheric impairments like absorption, cloud blockage and index-of-refraction turbulence and ways for their mitigation are explained. As at least one communication partner is mobile in these link scenarios, the pointing, acquisition and tracking issues are also regarded. Practical link examples will be presented.

**Friday, November 18, 2011**  
**08.30 – 12.30**

08.30 – 10.00 H. Brandt	<b>Demonstration of a Channel Simulation Tool and a System Simulator for Performance Assessment of SatCom Systems</b> Demonstration of a channel simulation tool for Ku- and Ka-band multibeam satellite systems, a simulator for DVB-S2/RCS multibeam systems; Demonstration of adaptive coding and modulation as a means for rain fade mitigation in Ka-Band;
10.30 – 12.00 T. Jost	<b>Live Laboratory Demonstration of Indoor-to-indoor propagation Measurements</b> Typical hardware and principle of measurement, limitations and problems, live demonstration, data evaluation;
12.00 – 12.30 M. Chandra	<b>Concluding Remarks and Discussions</b>