



Advancement of Radar System and Its Potential Applications

(March 26-30, 2018)

Venue: Indian Institute of Technology Roorkee, Roorkee-247667, Uttarakhand, India

Overview

An apparatus for the detection of remote objects has been patented by Christian Huelsmeyer in 1904. This type of apparatus was later coined RADAR, which stand for RADio Detection And Ranging. Since then electromagnetic sensors came a long way, today they are nearly everywhere present, most times not visible.

The Radar function comprises the transmitter, the propagation channel with target interaction and the receiver. This means, that the complete transmit/receive function is realized in one system, including all the RF components, oscillator, filter, power amplifier, antennas and so on, target Radar cross section, the complete receiver and the signal processing.

In the lecture the system aspects of the different types of radar and their specialties and applications are of primary interest. Following the *History* introduction, *Basic Electromagnetics* and *Wave Propagation Phenomena* the *Radar Equation* is derived and analyzed regarding *Information Content*, *Resolution and Accuracy* and *Noise and Detection*. Then the real system engineering starts with the classification of *Radar Types*, e.g. *CW-Radar*, *FM-CW-Radar*, *Pulse Radar*, *MTI-RADAR*, *Mono-Pulse-Radar*, *Bistatic Radar*, *Noise Radar* and *UWB-Radar*. In the next years the state of the art Radar system concepts will experience almost a revolution; the implementation of the technologies that are available since quite some years, mostly resulting from communication technologies, has been too long delayed. The major ideas/technologies for future Radar system concepts are:

- a) intelligent signal coding
- b) MIMO Radar
- c) digital beam-forming
- d) array imaging
- e) combination Radar x communication = RadCom

These new technologies will allow completely new functions and applications and they can replace most of the existing system concepts. The Radars of the future will render more

information, be more flexible and it will also be smaller and significantly cheaper. The presentation will explain these new technologies and show their integration for the Radar of the future.

These lectures include applications, where especially *Automotive Radar* is stressed.

Regarding the radar components, especially the *Antennas* are dealt with, including *Array* and *Phased Array Antennas*.

An important aspect of Radar is Polarization and the Target interaction. These lecture parts include *Polarimetry* and the *Target Radar Cross-Section* analysis. Here especially the *Radar - and Target Calibration* are of importance and detailed.

The lecture concludes with *Synthetic Aperture Radar (SAR)* for scanning our earth from air and space. The state of the art functions, including most present *SAR Modes* and *Digital Beam-forming* will be presented.

Objective:

In the past years radar has developed from primarily military applications to a mass product with multimillions of radars for automotive, industry 4.0 or security. The intention of the course is to make young engineers and scientists aware of the present and future technologies with its advancement in radar system engineering:

- I) Explain the physical background, electromagnetic waves, wave propagation
- II) Present the state of the art radars
- III) Introduce to the future radar system engineering
- IV) Future radar applications, especially automotive radar and security application
- V) Explain airborne and space-borne synthetic aperture radars

Course Information	Duration: March 26-March 30, 2018
Modules	<p>Module 1: Historical journey of Radar, Wave propagation overview</p> <p>Module 2: Radar Equation and Radar Classification</p> <p>Module 3: Future Radar Systems, OFDM Radar Coding, MIMO 3D-MIMO DBF, RadCom,</p> <p>Module 4: Polarimetric Radar, Radar Cross Section and its Reduction, Automotive Radar</p> <p>Module 5: Synthetic Aperture Radar Principle and Performance Parameter</p> <p>Number of participants for the course will be limited to fifty.</p>
You Should Attend If...	<ul style="list-style-type: none"> • Engineers, Executives and researchers from companies, service and government organizations including R&D laboratories. • Student students at all levels (BTech/MSc/MTech/PhD) • Faculty from reputed academic institutions and technical institutions.
Fees	<p>The participation fees for attending the course is as follows:</p> <ul style="list-style-type: none"> • Participants from abroad: US \$500 • Industry/ Research Organizations: Rs. 12000.00 • Academic Institutions (Faculty): Rs. 7000.00 • Academic Institutions (Students): Rs. 3000.00 • Academic Institutions (SC/ST Students) : Rs. 2000.00 <p>➤ Students have to submit a letter from their institute as proof of full time student enrollment. SC/ST students will have to submit a valid Caste/Tribe Certificate.</p> <p>The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility.</p> <p>Fee does not include accommodation and food. On request basis, participants may be provided with accommodation on payment basis.</p> <p>Note: Accommodation:</p> <ol style="list-style-type: none"> 1. The registration fee should be sent in advance through bank draft drawn in favor of "Dean SRIC, IIT Roorkee" and payable at Roorkee latest by Feb. 28, 2018. 2. The Complete form along with payment may please be sent to: Prof. Dharmendra Singh, Department of Electronics and Communication Engineering, IIT Roorkee, Roorkee-247667, Uttarakhand, e-mail: dharmfec@iitr.ac.in

The Faculty



Werner Wiesbeck (SM 87, F 94) received the Dipl.-Ing. (M.S.E.E.) and the Dr.-Ing. (Ph.D.E.E.) degrees from the Technical University Munich in 1969 and 1972, respectively. From 1972 to 1983 he was with AEG-Telefunken in various positions including that of head of R&D of the Microwave Division in Flensburg and marketing director Receiver and Direction Finder Division, Ulm. During this period he had product responsibility for mm-wave radars, receivers, direction finders and

electronic warfare systems. From 1983 to 2007 he was the Director of the Institut für Höchstfrequenztechnik und Elektronik (IHE) at the University of Karlsruhe (TH) and he is now Distinguished Senior Fellow at the Karlsruhe Institute of Technology (KIT). Research topics include antennas, wave propagation, Radar, remote sensing, wireless communication and Ultra Wideband technologies. He is author and co-author of several books and of more than 800 publications, supervisor of more than 90 PhDs, and responsible supervisor of over 600 Diploma-/Master theses and he holds over 60 patents. In 1989 and 1994, respectively, he spent a six months sabbatical at the Jet Propulsion Laboratory, Pasadena. He is a member of the IEEE GRS-S AdCom (1992-2003), Chairman of the GRS-S Awards Committee (1994 – 1998, 2002 -), Executive Vice President IEEE GRS-S (1998-1999), President IEEE GRS-S (2000-2001), Associate Editor IEEE-AP Transactions (1996-1999), past Treasurer of the IEEE German Section (1987-1996, 2003-2007). For the Carl Cranz Series for Scientific Education he serves as a permanent lecturer for Radar Systems Engineering, wave propagation and mobile communication network planning. He was a member of an Advisory Committee of the EU - Joint Research Centre (Ispra/Italy), and he is an advisor to the German Research Council (DFG), to the Federal German Ministry for Research (BMBF) and to industry in Germany. He is the recipient of a number of awards, lately the IEEE Millennium Award, the IEEE GRS Distinguished Achievement Award, the Honorary Doctorate (Dr. h.c.) from the University Budapest/Hungary, the Honorary Doctorate (Dr.-Ing. E.h.) from the University Duisburg/Germany, the Honorary Doctorate (Dr.-Ing. E.h.) from the Technische Universität Ilmenau and the IEEE Electromagnetics Award 2008. He is a Life Fellow of IEEE, an Honorary Life Member of IEEE GRS-S, a Member of the Heidelberger Academy of Sciences and Humanities and a Member of the German Academy of Engineering and Technology (acatech). He is a member of a number of national and international Awards Committees.



Dharmendra Singh received his Ph. D degree in Electronics Engineering from Indian Institute of Technology (Banaras Hindu University) Varanasi, Varanasi, U.P., India. He received various fellowships and awards by the national and international bodies mainly Monbusho Fellowship, Japan, UCAR Fellowship, USA, MERIT Fellowship, European Union, DAAD Fellowship, Germany, TWAS Fellowship, China, IFCAM Fellowship,

France, TWAS Fellowship, Brazil and many others. He worked as Visiting Scientist/Post doc Fellow at Information Engineering Department, Niigata University, Japan, German Aerospace Center, Germany, Institute for National Research In Informatics and Automatique, France, Institute of Remote Sensing Application, Beijing, China, Karlsruhe University, Germany, UPC, Barcelona, Spain and visited several other laboratories in other countries. Currently he is working as Professor in Electronics and Communication Engineering Department, Indian Institute of Technology Roorkee, India. He is also the Coordinator of RailTel-IIT Roorkee Center of Excellence in Telecommunication. He has guided 22 Ph.D students and 12 are pursuing their Ph.d and guided more than 65 M. Tech students. He has published more than 300 research papers in reputed international/national journals and conferences.

Course Coordinator

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<http://www.gian.iitkgp.ac.in/GRE GN>

Indian Institute of Technology Roorkee

Registration Form

Advancement of Radar System and Its Potential Applications

(MHRD Scheme on Global Initiative on Academic Network (GIAN))

March 26 - 30, 2018

- Name
- Designation
- Affiliation
- Address for Correspondence
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- Email:
- Phone No:
- Accommodation required: **Yes / No**
- Type: Hotel/Hostel/Guest House (accommodation shared basis may be available @Rs. 500/ per day)
- Cheque/DD No.
- Dated for Rs.

Date

Signature of the participant

Note:

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2. The Complete form along with payment may please be sent to:

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