Radar Signal Processing:
Fundamentals, Applications, and Advanced Topics

June, 26 – 30, 2017
Oberpfaffenhofen near Munich

Scientific Coordination
Dr. Greg Showman
Georgia Tech Research Institute, Atlanta, GA

Who Should Attend
Engineers, scientists, managers, and technicians responsible for the design, development, evaluation, and testing of modern radar systems • Radar and RF/MMW missile seeker engineers • Personnel involved in high-resolution/ imaging radar applications • Radar designers involved in clutter-limited target detection

Focus
Modern radars strive for increased performance; however, dramatic improvements in radar components are becoming more difficult to achieve after decades of refinement. In contrast, computer processing power continues to grow exponentially, enabling on-board real-time implementation of traditional Fourier-based techniques as well as more advanced algorithms. Radar systems today employ advanced waveform generators and collect wideband data with a significant degree of coherence, which allow tremendous increases in performance if the proper signal processing is implemented to exploit these features.

The seminar provides a comprehensive overview of the basics of radar with an emphasis on the role of signal processing and applications of these fundamentals to more advanced radar modes such as synthetic aperture radar (SAR) and ground moving target indication (GMTI) radar. This begins with a review of the underlying concepts from general digital signal processing, linear algebra, and random processes, which will provide the basis for a presentation of techniques employed by modern radar systems including pulse compression waveforms, Doppler processing, and antenna array-based techniques.

With these fundamentals in hand, more advanced techniques such as the detection of slow-moving targets against a clutter background with GMTI processing and the formation of high-resolution imagery with SAR become accessible. The basic operating principles of these modes will be presented as well as a discussion of factors affecting system performance.

Contemporary concepts in radar will be discussed. These include solutions to the difficult problem of target tracking in dense environments and the novel concept of multiple-input, multiple-output (MIMO) radar that has been borrowed from the field of communications. Model based approaches inspired by spectral analysis will be presented along with those from the new field of compressed sensing.

This seminar will provide a strong grounding in the fundamentals of radar signal processing and give the attendee ample opportunity to see how these are applied in radar systems today and what the future may hold.

Lecturers
Dr. Mike Davis
Georgia Tech Research Institute, Atlanta, GA
Dr. Greg Showman
Georgia Tech Research Institute, Atlanta, GA
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**Seminar Outline**

### Monday, June 26, 2017 

10.15 – 10.30 **Introduction**

10.30 – 12.00 **Radar and Signal Processor Basics**

13.00 – 14.30 **Radar range equation and basic detection theory**

15.00 – 16.30 **Basic signal radar related processor concepts and implementation**

**Tuesday, June 27, 2017**

08.30 – 10.00 **Fundamentals of Signal Processing**

10.30 – 12.00 **Detection Theory**

15.00 – 16.30 **Waveforms and Pulse Compression**

### Wednesday, June 28, 2017

08.30 – 10.00 **Moving Target Indication (MTI) and Pulse Doppler (PD) Radar**

13.00 – 14.30 **Ground Moving Target Indication (GMTI) Radar**

15.00 – 16.30 **GMTI Performance Benchmarking**

### Thursday, June 29, 2017

08.30 – 10.00 **Synthetic Aperture Radar (SAR)**

10.30 – 12.00 **SAR Performance Benchmarking**

### Language

**English**

### Course Material

Each attendant will be provided with detailed course material in English, and will receive a free copy of the book:

- "Fundamentals of Radar Signal Processing", by Mark A. Richards
  McGraw Hill Electronic Engineering, 2005

### Additional Courses

- "SAR Principles and Application", 23.–27.10.2017 (Code SE 2.06)
- "Radartechnik für Entwickler und Systemingenieure", 13.–16.11.2017 (SE 2.38)