



Module Description for Block Week Module:

Module title	Radar Systems
Offering course of studies	Embedded Systems Engineering / Digital Transformation
University Campus	FH Dortmund / Online
Language	English
Module representative/ Full-time lecturer	Prof. Dr. Andreas Becker (FH Dortmund)
Contact	andreas.becker@fh-dortmund.de

Abbreviation	Workload	Credits	Semester (WiSe/SuSe)	Planned group size	
				minimum	maximum
	180	6	WiSe	5	20
Courses/course types Attendance	Contact time		Self-study		
	Attendance during block week	Additional contact time during preparation and postprocessing	Guided during preparation and postprocessing	selfdirected	
	32	16	12	120	
Teaching types preparation	Online training material / lectures (4 dates in hybrid form: 20.10. / 27.10. / 3.11. / 10.11.2022, 8:30-12:00 a.m.)				
Teaching types postprocessing	Online meetings and consulting, lectures (3 dates in hybrid form: 1.12. / 8.12. / 15.12.2022, 8:30-12:00 a.m.)				

Teaching results/ teaching goals/competences
<p>Goal: Implementation of a radar based traffic alert system</p> <p>5.1 Knowledge</p> <ul style="list-style-type: none"> • Knows relevant basics of wave propagation and antenna theory • Knows basic elements of radar sensors including modulation • Knows major blocks of radar signal processing including state estimation • Knows current trends in radar signal processing



5.2 Skills

- Can implement basic algorithms like target detection, angle finding and sub-bin range estimation
- Can implement basics tracking algorithms

5.3 Competence - attitude

- Can discuss requirements and features in the area of automotive radar
- Understands limitations and translates between different domains
- Can lead cross domain usage of radar sensors

Contents

In conjunction with LiDAR and cameras, radars sensors are a key technology for automated driving. This module introduces students into radars sensors with an emphasis on signal processing. Several case studies are discussed based on Matlab-Code and usage of demonstration boards of vendors like Texas Instruments.

- Wave propagation and antennas
- Block diagram
- Modulation
- Spectral analysis
- State Estimation and Tracking
- Current trends in radar signal processing
- Applications

Participation requirements

Programming (Matlab and Python), Linux, higher mathematics, stochastic signal processing

Examination types

Presentation and written exam

Requirement for rewarding credit points

Written exam at the end of the semester

Application of the modul (in other courses)

siehe hierzu Homepage der Ruhr Master School

Literature

Stergiopoulos, Advanced Signal Processing, CRC Press, 2009

Kay, S.; Fundamentals of Statistical Signal Processing, Vol. I: Estimation Theory, Prentice Hall, 1993

Mahafza, Radar Signal Analysis and Processing using Matlab, CRC Press, 2016 Winner, Handbuch Fahrerassistenzsysteme, Springer, 2015

IEEE explore: Several papers will be used throughout lecture