

MK118 - Cognitive and Software Defined Radio

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General information	
Module Code	MK118
Unique Identifier	CognSWDefRad-01-MA-M
Module Leader(s)	Prof. Dr. Badri-Höher, Sabah (sabah.badri-hoeher@haw-kiel.de)
Lecturer(s)	Prof. Dr. Badri-Höher, Sabah (sabah.badri-hoeher@haw-kiel.de)
Offered in Semester	Wintersemester 2018/19
Module duration	1 Semester
Occurrence frequency	Regular
Module occurrence	In der Regel im Wintersemester
Language	Englisch
Recommended for international students	Yes
Can be attended with different study programme	Yes

Curricular relevance (according to examination regulations)
Study Subject: M.Eng. - MET - Elektrische Technologien (PO 2017, V3) Study Specialization: Kommunikationstechnik und Embedded Systems Module type: Wahlmodul Semester: 1, 2, 3
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: Intelligent Systems Module type: Wahlmodul Semester: 1, 2, 3
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: Information Technology and Systems Module type: Wahlmodul Semester: 1, 2, 3
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: Business IT-Management Module type: Wahlmodul Semester: 1, 2, 3
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: IT Security Module type: Wahlmodul Semester: 1, 2, 3

Qualification outcome
<i>Areas of Competence: Knowledge and Understanding; Use, application and generation of knowledge; Communication and cooperation; Scientific self-understanding / professionalism.</i>
After successful completion of this module, the students will be able to develop intelligent methods which can be used to automatically adapt the data rate of digital data transmission systems with respect to the available frequencies.

The students will be capable to describe concepts of Software Defined Radio (SDR) and Cognitive Radio (CR), and will be able to use them in digital transmission. Furthermore the students will acquire a deep knowledge about different SDR architectures and will be capable to compare and evaluate their realization. Based on the Red Pitaya board, they will have the opportunity to visualize the functionality of different components and will obtain experience about the requirement of transmitter and receiver design.

In lab experiments, the students will emulate different data transmission methods. They will use the Red Pitaya board as a platform and integrate their transmitter and receiver C/C++ programs in order to perform adaptive data transmission. They will exploit different modulation schemes as well as different receiver concepts. The students will be able to test and measure the performance of their developed systems with respect to different transmission scenarios.

Due to group-wise problem solving with typically just two students per group, problems can be solved efficiently. Soft skills like communication skills will be trained. The students will learn to split complex problems into sub-tasks and to join the corresponding sub-results.

Content information

Content	<p>Definiton and history of Software Defined Radio and Cognitive Radio. Software Defined Radio (SDR): Concept and implementation possibilities, Software architectures, GNU radio and USRP, RedPitaya-board. Transmitter and Receiver Design: Digital modulation, pulse shaping, Receiver filtering, detection, equalization. Concept and architectures of Cognitive Radio. Spectrum sensing, spectrum sharing, spectrum decision, spectrum mobility.</p> <p>Applications: Wireless communication systems, digital radio systems, multiband cognitive radio systems</p>
Literature	<p>J. Mitola: The Software Radio Architecture. IEEE Commun. Mag., vol.33, no. 5, pp. 26-38, 1995.</p> <ul style="list-style-type: none"> - J. Mitola: Cognitive Radio: An Integrated Agent Architecture for Software Defined Radio. Royal Institute of Technology (KTH), 2000. - J.Proakis, Principles, Algorithms, and Applications, Prentice Hall. - F.K.Jondral: Software-Defined Radio-Basics and Evolution to Cognitive Radio. EURASIP JOURNAL on Wireless Comm. and Networking, 2005. - A.R. Rhiemeier: Modular Software-Defined Radio. EURASIP JOURNAL on Wireless Comm. and Networking, 2005.

Teaching formats of the courses

Teaching format	SWS
Labor	1
Lehrvortrag	2
Übung	1

Workload

Number of SWS	4 SWS
Credits	5,00 Credits
Contact hours	48 Hours
Self study	102 Hours

Module Examination

Examination prerequisites according to exam regulations	None
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MK118 - Präsentation	Method of Examination: Präsentation Duration: 30 Minutes Weighting: 40% wird angerechnet gem. § 11 Absatz 2 PVO: Yes Graded: Yes
MK118 - Klausur	Method of Examination: Klausur Duration: 90 Minutes Weighting: 60% wird angerechnet gem. § 11 Absatz 2 PVO: Yes Graded: Yes