

关。GDAŃSK UNIVERSITY 创 OF TECHNOLOGY

Subject card

Subject name and code	Source and Channel Coding in Radio Communication Systems, PG_00047471							
Field of study	Electronics and Telecommunications							
Date of commencement of studies	October 2022		Academic year of realisation of subject		2023/2024			
Education level	second-cycle studies		Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery			at the university		
Year of study	2		Language of instruction			English		
Semester of study	3		ECTS credits			3.0		
Learning profile	general academic profile		Assessment form		assessment			
Conducting unit	Department of Radiocommunication Systems and Networks -> Faculty of Electronics, Telecommunications and Informatics							
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Małgorzata Gajewska					
	Teachers		dr inż. Andrzej Marczak					
			dr inż. Małgorzata Gajewska					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0		0.0	45
	E-learning hours incl	uded: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study		SUM
	Number of study hours	45		6.0		24.0		75
Subject objectives	The aim of the course is to familiarize							
	students with the methods of source and						e and	
	channel coding.							

Learning outcomes	Course outcome	Subject outcome	Method of verification	
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student can perform simulation software work of channel coder.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment	
	[K7_U07] can apply advanced methods of process and function support, specific to the field of study	The student can use acquired knowledge regarding basic coding methods source and channel to understanding of operating methods practically used encoders	[SU1] Assessment of task fulfilment	
	[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	The student knows and understands what role play individual blocks functional in encoders.	[SW1] Assessment of factual knowledge	
	[K7_W05] Knows and understands, to an increased extent, methods of process and function support, specific to the field of study.	Student zna metody własności sygnałów metody oraz podstawowe metody oceny jakości sygnałów mowy	[SW1] Assessment of factual knowledge	
	[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	The student knows and is able to discuss basic operating methods source and channel coders.	[SU3] Assessment of ability to use knowledge gained from the subject	

Subject contents	Purpose and basic concepts of source
	coding, properties and models of the
	source of speech signals. Modeling of
	the vocal tract. Scalar linear and
	nonlinear quantization. Review of basic
	source coding methods. Fundamentals
	of coding type analysis by synthesis,
	codecs: MPLP, RPE. Fundamentals of
	coding analysis by synthesis, codecs:
	CELP, VSELP. Criteria for assessing the
	quality of synthesized speech signals.
	RPE-LTP-LPC codec in the GSM
	system. Short-term predictive analysis.
	Long-term predictive analysis. Excitation
	signal synthesis, APCM quantization,
	transmission frame forming, RPE-
	LTPLPC decoder. AMR-ACELP coding
	in the UMTS / GSM system, speech
	signal sending / receiving mechanisms,
	variable rate coding, transmission frame
	format. Short-term and long-term
	predictive analysis in the ACELP
	encoder, adaptive code book Algebraic
	code table, AMR-ACELP decoder. AMR-
	WB ACELP codec. Application of cyclic
	codes in radiocommunication systems,
	examples of encoders and decoders.
	Convolutional coding, code description
	using generating functions and lattice
	graph. Correction ability of convolutional
	codes, free Hamming distance. Soft and
	nard-coding decoding of convolutional

codes. Viterbi's algorithm. Computational complexity of the Viterbi algorithm. MAP decoding algorithm. Systematic and unsystematic convolutional codes. The use of convolutional codes in radiocommunication systems. Interleaving of code strings of convolutional codes. Excluding bits from convolutional code strings and their decoding, the impact of exclusion on correction capabilities. Turbocodes, work principle, correction abilities. Turbocodes in radiocommunication systems. Turbocode decoding. LDPC codes. Decoding LDPC codes.

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Prerequisites and co-requisites					
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade		
	source coding lecture	50.0%	35.0%		
	project	50.0%	30.0%		
	channel coding lecture	50.0%	35.0%		
Recommended reading	Basic literature	Goldberg R. (ed.), A Practical Handbook of Speech Coders. CRC Press LLC, 2000. Hanzo L., Somerville C., Woodard J.: Voice and Audio Compression for Wireless Communications, 2nd Edition. Wiley & Sons, 2007.			
	Supplementary literature	No requirements			
	eResources addresses	Adresy na platformie eNauczanie:			
		Source and Channel Coding in Radio Communication Systems 2023/2024 - Moodle ID: 33136 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33136			
Example issues/ example questions/ tasks being completed	Discuss the operation of the CELP encoder				
	Viterbi's algorithm.				
Work placement	Not applicable				