TECHNISCHE HOCHSCHULE LÜBECK

Module: Digital Processing of Stochastic Signals

Level	Master	**Short Name**	DPSS
Responsible Lecturers	Chahabadi, Djahanyar, Prof. Dr.-Ing.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Written Exam	**Exam Language**	German/English
Exam Length (minutes)	120	**Exam Grading System**	One-third Grades

Learning Outcomes	After successful completion of this course, the students will be able to: • Describe stochastic signals mathematically using expectations like the first and second moments of a stochastic process. • Represent stochastic signals in the time domain and the frequency domain and to classify them. • Apply the structure of digital systems for processing stochastic signals including two different predictor structures. • Describe and apply different adaptation strategies and be familiar to the design of adaptive filters. • Name typical applications of the presented systems. • Design predictors and quantizers for a given training sequence. • Make use of stochastic features of a given signal for data compression. • Describe the basic structures of different systems for source coding.
Participation Prerequisites	

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Module Course: Digital Processing of Stochastic Signals (Lecture)

(of Module: Digital Processing of Stochastic Signals)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Cha. 1: IntroductionContent and organization of the course, features of stochastic signals, basic model of information transmission. • Cha. 2: Introduction to ProbabilityEvents, random variables and probability, discrete and continuous random variables, stochastic processes, autocorrelation function. • Cha. 3: PredictionBasic idea, structure of the predictor, derivation of the optimal prediction, the prediction gain, the Levinson Durbin-Algorithm, prediction with lattice filters. • Cha. 4: Adaptive FiltersWiener-filter , LMS-Algorithm, Kalman-Filter. • Cha. 5: QuantizationScalar quantization, companding, block quantization, Karhunen-Loeve-transform, vector quantization, the LBG-Algorithm. • Cha. 6: Principles of AdaptationForward adaption, backward adaptation, main and side information, constant and variable data rates. • Cha. 7: ApplicationsSource coding: RELP, DPCM, G.726(ADPCM), G.722 (SB-ADPCM),G.728 (LD-CELP), ETSI/ GSM Standard 06.10 (RPE-LTP), MP3, feature extraction, signal enhancement, echo cancellation, adaptive channel equalization, adaptive beam forming
Literature	In English:

	• P.S.R. Diniz, Adaptive Filtering, Kluwer Academic Publishers, 2002, ISBN 1-4020-7125-6 • Papoulis, Probability, Random Variables and Stochastic Processes, McGraw-Hill, 2002, ISBN 0- 0711-9981-0 In German: • F.Jondral, A.Wiesler, Wahrscheinlichkeitsrechnung und stochastische Prozesse, Teubner Verlag, 2002, ISBN 3-5191-6263-6 • E.Hänsler, Statistische Signale Grundlagen und Anwendungen, Springer Verlag, 2001, ISBN 3-5404- 1644-7 • W.Hess, U.Heute, P.Vary Digitale Sprachsignalverarbeitung Teubner Verlag, Stuttgart, 1998, ISBN 3-519-06165-1, ISBN-13 978-3519061656 • J.F. Böhme, Stochastische Signale, Teubner Verlag, 1998, ISBN 3-5191-6160-5
Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Module Course: Digital Processing of Stochastic Signals (Practical Training)

(of Module: Digital Processing of Stochastic Signals)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size		**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	To deepen and expand the practical knowledge the students will solve three problems out of a set of given problems using MATLAB on a PC.Topics are: Signal analysis and measurement of the autocorrelation function, adaptive gain control using the probability density function, design of a linear predictor for speech signals, programming an adaptive lattice predictor, implementation of the LMS-Algorithm.
Literature	See lecture
Remarks	