

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Frequency Analysis of Signals

Academic year: 2019/2020 Code: ZSDA-3-0029-s ECTS credits: 2

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: dr hab. inż. Duda Krzysztof (kduda@agh.edu.pl)

Module summary

Frequency analysis of signals has many applications e.g.: linear system identification, speech processing, image processing, transient analysis, electric power system analysis, radar and sonar systems, communication, nuclear magnetic resonance spectroscopy, mechanical spectroscopy, economics, seismology, weather forecasting, and others. The lecture presents selected methods of frequency analysis: DFT, IpDFT, Prony, Matrix Pencil, and others.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Social competences to cooperate in teams working with frequency analysis of signals.	SDA3A_K01	Activity during classes
Skills: he can			
M_U001	Skill to implement, apply, evaluate, and compare methods for frequency analysis of signals.	SDA3A_U01	Activity during classes
M_U002	Skill to self study issues of frequency analysis of signals.	SDA3A_U07, SDA3A_U06, SDA3A_U01	Activity during classes
Knowledge: he knows and understands			
M_W001	Knowledge of methods for frequency analysis of signals.	SDA3A_W02, SDA3A_W01	Activity during classes

Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
15	15	0	0	0	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Social competences to cooperate in teams working with frequency analysis of signals.	+	-	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Skill to implement, apply, evaluate, and compare methods for frequency analysis of signals.	+	-	-	-	-	-	-	-	-	-	-
M_U002	Skill to self study issues of frequency analysis of signals.	+	-	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Knowledge of methods for frequency analysis of signals.	+	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	15 h
Realization of independently performed tasks	35 h
Summary student workload	50 h
Module ECTS credits	2 ECTS

Additional information

Module content

Lectures

Subjects:

1. The DFT and Time Windows.
2. The Spectrogram.
3. The Periodogram.
4. The Interpolated DFT.
5. The Cramér-Rao Lower Bound.
7. Parametric frequency estimation.
8. Frequency tracking.

Teaching methods and techniques:

Lectures: Lecture with the projector and blackboard.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

The final pass is received based on lecture attendance.

In case of lack of the attendance students are asked to prepare the report on the subject they have missed.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: Yes
- Participation rules in classes: Attendance

Method of calculating the final grade

The final grade is the pass of lectures.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

In case of lack of the attendance students are asked to prepare the report on the subject they have missed.

Prerequisites and additional requirements

Master degree in electrical engineering.

Recommended literature and teaching resources

S. M. Kay, Fundamentals of Statistical Signal Processing: Estimation Theory, Englewood Cliffs, NJ: Prentice-Hall, 1993.

A.V. Oppenheim, R.W. Schaffer, J.R. Buck, Discrete-Time Signal Processing, 2nd Edition, Prentice-Hall, 1999.

B. G. Quinn, E. J. Hannan, The Estimation and Tracking of Frequency, New York: Cambridge Univ. Press, 2001.

T.P. Zieliński, Cyfrowe przetwarzanie sygnałów, od teorii do zastosowań, WKŁ, Warszawa, 2005.

K. Duda, Fourierowskie metody estymacji widm prążkowych, Kraków, Wydawnictwa AGH, 2011.

Scientific publications of module course instructors related to the topic of the module

<https://bpp.agh.edu.pl/autor/duda-krzysztof-04141>

Additional information

None