

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Identification and signals analysis

Academic year: 2013/2014 Code: RMS-1-602-s ECTS credits: 4

Faculty of: Mechanical Engineering and Robotics

Field of study: Mechatronics with English as instruction language Specialty: —

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

Lecture language: English Profile of education: Academic (A) Semester: 6

Course homepage: —

Responsible teacher: prof. dr hab. inż. Staszewski Wiesław (w.j.staszewski@agh.edu.pl)

Academic teachers:

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			
M_K001	Understands the need of continuous knowledge updating		Activity during classes, Involvement in teamwork
Skills			
M_U001	Can perform sampling of time-continuous signals		Report, Execution of laboratory classes, Test results
M_U002	Can perform basic spectral signal analysis using suitable instruments and Matlab		Report, Execution of laboratory classes, Test results
M_U003	Can perform identification of simple second-order systems		Report, Execution of laboratory classes, Test results, Completion of laboratory classes
Knowledge			
M_W001	Has basic knowledge of signal and system description in time domain		Execution of laboratory classes, Completion of laboratory classes, Test results
M_W002	Has basic knowledge of signal and system description in frequency domain		Execution of laboratory classes, Test results, Completion of laboratory classes

M_W003	Knows and understands sampling effects of continuous-time signals		Execution of laboratory classes, Test results, Completion of laboratory classes
M_W004	Has basic knowledge of analog filters and mechanical system models		Execution of laboratory classes, Test results, Completion of laboratory classes
M_W005	Has basic knowledge of nonparametric spectrum estimation methods		Execution of laboratory classes, Test results, Completion of laboratory classes
M_W006	Has basic knowledge of system identification using frequency methods and modal analysis		Execution of laboratory classes, Test results, Completion of laboratory classes

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	Others	Fieldwork classes	Workshops	E-learning
Social competence												
M_K001	Understands the need of continuous knowledge updating	+	-	+	-	-	-	-	-	-	-	-
Skills												
M_U001	Can perform sampling of time-continuous signals	+	-	+	-	-	-	-	-	-	-	-
M_U002	Can perform basic spectral signal analysis using suitable instruments and Matlab	+	-	+	-	-	-	-	-	-	-	-
M_U003	Can perform identification of simple second-order systems	+	-	+	-	-	-	-	-	-	-	-
Knowledge												
M_W001	Has basic knowledge of signal and system description in time domain	+	-	+	+	-	-	-	-	-	-	-
M_W002	Has basic knowledge of signal and system description in frequency domain	+	-	+	-	-	-	-	-	-	-	-
M_W003	Knows and understands sampling effects of continuous-time signals	+	-	+	-	-	-	-	-	-	-	-
M_W004	Has basic knowledge of analog filters and mechanical system models	+	-	+	-	-	-	-	-	-	-	-

M_W005	Has basic knowledge of nonparametric spectrum estimation methods	+	-	+	-	-	-	-	-	-	-	-
M_W006	Has basic knowledge of system identification using frequency methods and modal analysis	+	-	+	-	-	-	-	-	-	-	-

Module content

Lectures

1. Introduction to signals and systems
 - Deterministic & stochastic signals
 - Energy and power signals
 - Continuous- and discrete-time signals
 - Sampling and coding
 - Linear time invariant (LTI) systems
2. Time domain analysis
 - Dirac delta, time domain models
 - Identification in time domain, impulse response
 - Convolution model
 - Stability and causality
3. Frequency domain analysis
 - Fourier transform
 - Frequency response, Bode diagram
 - Modeling mechanical systems
 - Time-frequency analysis
4. Sampling and Laplace transform
 - Sampling of time-continuous signals
 - Laplace transform, transfer function
 - Poles and zeros, stability
 - Analog filters
5. Discrete Fourier transform
 - Truncation in time
 - Rectangular window and sinc function
 - Discrete Fourier transform (DFT)
 - Nonparametric spectral estimation (periodogram)
6. Introduction to modal analysis
 - Modal models
 - Frequency response function
 - Excitation techniques
 - Frequency domain decomposition

Laboratory classes

Introduction to Matlab
 Signal processing in time domain
 Modeling of mechanical systems
 Signal processing in frequency domain
 Time-frequency methods and wavelets
 Elements of linear algebra
 Regression models

Method of least squares
Prediction error method
Nonparametric identification
Evaluation of estimators' performance
Model analysis – presentation

Project classes

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Method of calculating the final grade

Based on laboratory results (marks)

Prerequisites and additional requirements

Prerequisites and additional requirements not specified

Recommended literature and teaching resources

- J. S. Bendat, A.G. Piersol, Random Data: Analysis & Measurement Procedures, John Willey and Sons, New York, 2000
- B. Mulgrew, P. Grandt, J. Thompson, Digital Signal Processing, Concepts and applications, Palgrave Macmillan, Second edition, 2003
- R.B. Randall, Frequency Analysis, Brüel&Kjær, 1987
- S. Braun, Discover signal processing. An interactive guide for engineers, Wiley, 2008.

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

Additional scientific publications not specified

Additional information

None

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	15 h
Participation in laboratory classes	30 h
Preparation for classes	30 h
Preparation of a report, presentation, written work, etc.	30 h
Summary student workload	105 h
Module ECTS credits	4 ECTS