

Syllabus

Signals & Systems

<i>Mechanical Engineering and Robotics</i>	Field of study:	Mechatronics, Mechanical Engineering
	Specialisation:	All
	Level of study:	2 nd year (3 rd semester)
	System of education:	Bachelor degree

Proszę wpisać propozycje semestru (semestrów) w których przedmiot powinien być realizowany.

Course obligatory / optional				ECTS points:			
Semester	No. of hours	L	C	P	Lab	Seminar	Completion/Exam
<i>3rd</i>		30			15		C + E

Course content (Lecture)
Fall semester : 1. Basic terms and definitions – 1h 2. System models classification – 1h 3. Basic problems of analog and digital signal processing – 2h 4. Methods of signal processing; frequency and time domain methods – 2h 5. Modeling of signals – regression models of signals – 2h 6. Advanced methods of signal processing – 2h 7. Computer based system for signal acquisition and processing - 2h 8. Experiment planning, passive and active experiments – 2h 9. Introduction of system dynamics – basic models and methods – 2h 10. Linear system models and its identification (simple model) – 2h 11. Linear system models and its identification (complex multidegree of freedom systems- multi input multi output systems) – 2h 12. Modal analysis of mechanical systems basic problem sand methods – 2h 13. Modal analysis of mechanical systems advanced problems and methods – 2h 14. Nonlinear systems modeling and identification – 2h 15. Application of system models for control – 1h 16. Application of system models for design and operation (diagnostics) – 2h 17. Inverse identification problem and its application- 1h Spring semester

Course content (Classes)
Fall semester Spring semester

Course content (Project)
Fall semester Spring semester
Course content (Laboratory)
Fall semestr: Modeling of dynamic systems In MATLAB package, simulation of models, model property analysis (4h), Stochastic and harmonic signal analysis and interpretation of analysis results (2h),

Experimental testing of dynamic properties of mechanical system – modal analysis – experiment signal processing and modal parameters estimation using VIOMA Toolbox (6h), Passive experiment on rotating machinery, basic malfunction detection based on signal processing results (3h)
Spring semester

Course content (Seminar)

Fall semester
Spring semester

References (Basic):

Julius S. Bendat, Allan G. Piersol, Random Data: Analysis & Measurement Procedures, John Willey and Sons, New York, 2000
Julius S. Bendat, Allan G. Piersol, Engineering Applications of Correlation and Spectral Analysis, 2nd Edition, John Willey and Sons, New York, 1993
Simon Braun, Discover Signal Processing: An Interactive Guide for Engineers, John Willey and Sons, Chichester, 2008
Lennart Ljung, System Identification: Theory for the User (2nd Edition), Prentice Hall Information and System Sciences Series, Upper Saddle River, 1999
D.j. Ewins, Modal Testing, Theory, Practice, and Application (Mechanical Engineering Research Studies Engineering Design Series) , RSP Ltd, Hertfordshire, 2000.
J. S. Rao, Vibratory Condition Monitoring of Machines, CRC Press, Boca Raton, 2000.

References (Additional):

N.M.M. Maia, J.M.M. Silva Theoretical and Experimental Modal Analysis (Mechanical Engineering Research Studies. Engineering Control Series, 9), RSP Ltd, Hertfordshire, 1997,
T. Soderstrom, P. Stoica, System Identification, Prentice Hall, London, 1989.

Expected learning outcome:	Knowledge in signal processing and system identification and ability of practical application of learned methods
Language of instruction:	English
ERASMUS subject code:	
Prerequisites:	Mathematics, Statistics, Metrology
Assessment method:	Positive assessment of laboratory reports (3 reports) and minimum 50% of correct answers during 1 hour test (50 questions)
Unit:	2h lecture, 4 h lab.
Lecturer:	Tadeusz Uhl
Lecturer (Project / Laboratory):	Piotr Kurowski
Modified:	