Digital signal processing - opis przedmiotu

Informacje ogólne

Nazwa przedmiotu	Digital signal processing
Kod przedmiotu	06.0-WE-ELEKTP-DigSigProc-Er
Wydział	Wydział Informatyki, Elektrotechniki i Automatyki
Kierunek	Elektrotechnika
Profil	ogólnoakademicki
Rodzaj studiów	Program Erasmus pierwszego stopnia
Semestr rozpoczęcia	semestr zimowy 2020/2021

Informacje o przedmiocie

Semestr	5
Liczba punktów ECTS do zdobycia	5
Typ przedmiotu	obieralny
Język nauczania	angielski
Sylabus opracował	• dr inż. Mirosław Kozioł • dr hab. inż. Radosław Kłosiński, prof. UZ

Formy zajęć

Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Laboratorium	30	2	-	-	Zaliczenie na ocenę
Wykład	30	2	-	-	Egzamin

Cel przedmiotu

- To familiarize students with basic notions of the digital signal processing.
- To provide basic knowledge about fundamentals of a spectral analysis and digital filtration of discrete signals.
- To give skills in practical implementation of a spectral analysis and filtration of discrete signals.
- To provide knowledge about design of digital filters.

Wymagania wstępne

- Programming

Zakres tematyczny

Fundamentals of signal theory. Notion of signal. Classifications of signals. Mathematical models of selected signals. Fourier series and Fourier transform for continuous time signals. Fourier series and Fourier transform properties. An influence of a signal observation in finite time interval on its spectrum.

Analog-to-digital and digital-to-analog conversion. Chain of signal processing during analog-to-digital and digital-to-analog conversion. Sampling, quantization and coding. Quantization error. Spectrum of a sampled signal. Aliasing. Sampling theorem. Anti-aliasing filter. Recovery of an analog signal from samples.

Discrete Fourier transform (DFT). Derivation of amplitude and phase spectrum. Leakage. Parametric and non-parametric spectral windows. Spectrum resolution improvement by zero padding. Examples of spectral analysis of discrete-time signals and their interpretation.

Fast Fourier transform (FFT). Butterfly computation schema in radix-2 FFT algorithm. Computational profit.

Linear and causal time-invariant (LTI) systems. Definitions of a discrete, linear and time-invariant system. Definition of causal system. Convolution. Stability of LTI systems in BIBO sense. Difference equation.

Z-transform. The Z-transform definition. Z-transform properties. The transfer function. Poles and zeros of the transfer function. Pole locus and stability of a system.

Digital filters. Finite and infinite impulse response filters. Processing discrete-time signals by digital filters. Basic structures of digital filters. Determination and interpretation of the frequency response of digital filters. Significance of linear phase response in the processing of signal. Group delay.

IIR digital filter design by bilinear transformation method. FIR digital filter design by the method based on the windowed impulse response.

Introduction to discrete simulation of analog circuits

Metody kształcenia

- Lecture: conventional/traditional lecture with elements of discussion.
- Laboratory: laboratory exercises, work in groups with elements of discussion.

Efekty uczenia się i metody weryfikacji osiągania efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
Student can use digital signal processing to analyze discrete signals, perform its spectral analysis, and interpret the obtained graphs of spectra.		• bieżąca kontrola na zajęciach • wykonanie sprawozdań laboratoryjnych	• Laboratorium
Student can describe a discrete system using differential equations and transmittance.		• kolokwium	• Wykład
Student can write programs in C language, which make spectral analysis of signals and their filtering with the application of digital filters with finite and infinite impulse response.		• bieżąca kontrola na zajęciach	• Laboratorium
Student can design the infinite and finite impulse response digital filter.		• bieżąca kontrola na zajęciach	• Laboratorium

Warunki zaliczenia

- Lecture: to receive a final passing grade student has to receive positive grade from written tests conducted at least once a semester.
- Laboratory: to receive a final passing grade student has to receive positive grades in all laboratory exercises provided for in the laboratory syllabus.

Calculation of the final grade = lecture 50% + laboratory 50%

Literatura podstawowa

1. Lyons R.G.: Understanding Digital Signal Processing, Prentice Hall, 2004
2. Mitra S.: Digital Signal Processing: A Computer-Based Approach, McGraw-Hill, 2005
3. Orfanidis S.J.: Introduction *to Signal Processing*, Prentice Hall, 1999
4. Oppenheim A.V., Schafer R.W., Buck J.R.: *Discrete-Time Signal Processing*, Prentice Hall, 1999

Literatura uzupełniająca

1. Oppenheim A.V., Willsky A.S., Nawab H.: *Signals & Systems*, Prentice Hall, 1997
2. Owen M.: *Practical signal processing*, Cambridge University Press, 2007
3. Smith S.W.: Digital Signal Processing: A Practical Guide for Engineers and Scientists, Newnes, 2002

Uwagi

Zmodyfikowane przez dr hab. inż. Radosław Kłosiński, prof. UZ (ostatnia modyfikacja: 27-04-2020 23:34)