Signal processing using digital signal processors - opis przedmiotu

Informacje ogólne

Nazwa przedmiotu	Signal processing using digital signal processors
Kod przedmiotu	06.5-WE-ELEKTP-SPUDSP-Er
Wydział	Wydział Nauk Inżynieryjno-Technicznych
Kierunek	Elektrotechnika
Profil	ogólnoakademicki
Rodzaj studiów	Program Erasmus pierwszego stopnia
Semestr rozpoczęcia	semestr zimowy 2022/2023

Informacje o przedmiocie

Semestr	5
Liczba punktów ECTS do zdobycia	5
Typ przedmiotu	obieralny
Język nauczania	angielski
Sylabus opracował	• dr hab. inż. Krzysztof Sozański, 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
Wykład	30	2	-	-	Egzamin
Laboratorium	30	2	-	-	Zaliczenie na ocenę

Cel przedmiotu

- to familiarize students with basic concepts, methods, description and analysis of discrete systems;

- to familiarize with methods of description and analysis of multirate digital circuits;

- to mastery by students ability to apply theory of digital filters;

- introduction to theory and mastery of the basic methods of discrete simulation of digital circuits;

- to give basic skills of observation of the behavior and take of characteristics of electric circuits;

- to give basic skills in the design and realization of digital circuits using digital signal processors;

Wymagania wstępne

Circuit Theory, Microprocessor Systems, Computer Science

Zakres tematyczny

Analog and digital signal processing. Properties of signals. Analog (continuous-time) signals, discrete time signals. Signal parameters.

Analog signal processing. Analog circuits, linear two-port network. Continuous-time filters. Filter parameters. Introduction to analog filter design.

Signal discretization. Uniform and non-uniform signal sampling. Analog-to-digital (A/D) and digital-to-analog (D/A) signal conversion. A/D and D/A signal converters. Examples of multimedia and measurements data signal conversions.

Linear time-invariant (LTI) circuit. Discrete Fourier transform (DFT). Leakage effects. Widows. Properties of DFT. Fast Fourier transform (FFT). Z transform. Properties of Z transform.

Multirate digital signal processing. Decimation and interpolation. Implementation of multirate digital signal processing algorithms. Applications of multirate signal processing: noise shaping technique in delta-sigma modulator (DSM) used in A/D and D/A converters.

Digital modulations: pulse width modulation (PWM), pulse density modulation PDM, pulse code modulation PCM, differential pulse code modulation.

Digital filters: linear and nonlinear filters, multirate filters, filter banks, multidimensional filters. Properties of digital filters: finite impulse response filter (FIR), infinite response filter (IIR). Design of digital filters.

Round off effects in digital filters. Implementation of digital filters using digital signal processors.

Switched Capacitor (SC) filters.

Signal processing of random processes. Adaptive systems.

Subband coding. Design of filter banks. Wavelet transform.

Metody kształcenia

Lecture, laboratory exercises.

Efekty uczenia się i metody weryfikacji osiągania efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
Can design, implement and test a digital filter for signals. Can design and test signal processing digital algorithm. Can design a system converting signals from analogue to digital and vice versa.		• bieżąca kontrola na zajęciach	• Laboratorium
Is aware of the dynamic development of signal processing methods. Can establish the basic parameters of the signal recorded using a digital oscilloscope		• egzamin - ustny, opisowy, testowy i inne	• Wykład
Knows fundamentals of digital signal processing useful in multimedia systems. Knows specifics of energy signals into audio conversion. Knows hardware for algorithm implementation of digital signal processing		• bieżąca kontrola na zajęciach • egzamin - ustny, opisowy, testowy i inne	• Wykład • Laboratorium

Warunki zaliczenia

Lecture – in order to get a credit it is necessary to pass all of the required tests (oral or written).

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Calculation of the final grade: lecture 60% + laboratory 40% .

Literatura podstawowa

1. Proakis J. G., Manolakis D. M., *Digital Signal processing, Principles, Algorithms, and Applications*, Third Edition, Prentice Hall Inc., Engelwood Cliffs, New Jersey 1996.

2. Lyons R., *Understanding digital signal processing*, Prentice Hall, 2004.

3. Oppenheim A. V., Schafer R. W., *Discrete-time signal processing*, Prentice Hall, New Jersey, 1999.

4. Stallings W., *Computer Organization and Architecture*, Pearson, 2015.

5. Vaidyanathan P. P., *Multirate Systems and Filter Banks*, Prentice Hall Inc., Engelwood Cliffs, New Jersey 1992.

6. Wanhammar L., *Digital Filters*, Linkoping University, 1996.

7. K. Sozanski, Digital Signal Processing in Power Electronics Control Circuits, second edition, Springer-Verlag London, 2017.

8. Embree P. M., Kimble B., *C Language Algorithms for Digital Signal Processing*, Prentice Hall, 1991.

Literatura uzupełniająca

1. Dahnoun N., Multicore DSP: From Algorithms to Real-time Implementation on the TMS320C66x SoC, Wiley, 2018

2. P. S. R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Springer, 2020.

3. McFarland G., *Microprocessor Design (Professional Engineering)*, McGraw-Hill Professional, 2006.

Uwagi

Zmodyfikowane przez dr hab. inż. Krzysztof Sozański, prof. UZ (ostatnia modyfikacja: 21-04-2022 23:15)