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| **Course code** | CTU15 |
| **Course title** | Digital Signal and Image Processing with Applications |
| **Institution** | Czech Technical University in Prague |
| **Course address** | University of Chemistry and Technology, Faculty of Chemical Engineering, Technicka 5, CZ-166 28 Prague 6, Czech Republic |
| **City** | Prague |
| **Minimum year of study** | 3rd year  |
| **Minimum level of English** | None  |
| **Minimum level of French** | None  |
| **Key words** | Digital signal processing (DSP), discrete Fourier transform, wavelet transform, multidimensional signal processing, adaptive systems, computational intelligence, pattern recognition, digital filters, biomedical signals, environmental signals, energy consumption signals, Matlab environment  |
| **Language** | English |
| **Professor responsible** | Ales PROCHAZKA |
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| **Participating professors** |  |
| **Number of places** | Minimum: 8, Maximum: 15, Reserved for local students: 0  |
| **Objectives** | The main goal of the course is to:1. present selected mathematical and algorithmic structures in MATLAB environment used for signal analysis and processing2. study fundamentals of discrete Fourier transform and its properties in connection with signal and image analysis and discretization3. analyse principles if digital filtering in the time (FIR, IIR) and frequency domains for signal de-noising and image enhancement4. discuss selected mathematical methods of signal analysis and to present fundamentals of wavelet transform in signal decomposition, modification and reconstruction with applications5. summarize basic principles of signal modelling, pattern recognition and computational intelligence using both linear and nonlinear methods including neural networks6. present selected applications of signal processing in environmental engineering, biomedical signal and image processsing, and energy consumption data prediction It is supposed that course participants will be able to use the MATLAB environment to solve selected problems of the interdisciplinary area of signal and image processing, to use its visualization tools, and to study selected applications of digital signal processing methods. |
| **Programme to be followed** | Five 3-hour lectures:1. Signal and system modelling, algorithmization in the MATLAB environment, visualization, programming tools2. Principles of the discrete Fourier transform, properties, applications3. Digital filtering using difference equations and frequency domain analysis4. Approximation of functions, discrete wavelet transform, basic definitions, signal decomposition, de-noising, reconstruction5. Computational intelligence, neural networkds, pattern recognition Three 1 hour case studies: 1. DSP in environmental engineering (air pollution data modelling) 2. DSP in prediction (modelling of energy consumption data)3. DSP in biomedical signal and image processingFour 2-hour seminar work:1. Programming in MATLAB, structured data, computer graphics2. Application of DSP and optimization in pattern recognition3. Application of DSP in sleep, breathing and motion analysis4. Colloquium with presentation of selected case studiesExcursions:Czech Institute of Informatics, Robotics and Cybernetics, Digital Signal Processing Laboratory, Technical Museum  |
| **Prerequisites** | Basic knowledge of numerical mathematics.  |
| **Course exam** | Continuous evaluation through laboratory exercises and an evaluation during the final colloquium.  |
| **Publish on the web** | Yes: <http://uprt.vscht.cz/prochazka/pedag/ATHENSe.htm>  |
| **Session** | November 2017 |
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