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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 |
| **Telephone** | 420 220 444 198 |
| **Fax** | 420 220 445 053 |
| **Email** | [A.Prochazka@ieee.org](mailto:A.Prochazka@ieee.org) |
| **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 processing 2. study fundamentals of discrete Fourier transform and its properties in connection with signal and image analysis and discretization 3. analyse principles if digital filtering in the time (FIR, IIR) and  frequency domains for signal de-noising and image enhancement 4. discuss selected mathematical methods of signal analysis and to  present fundamentals of wavelet transform in signal decomposition,  modification and reconstruction with applications 5. summarize basic principles of signal modelling, pattern recognition and computational intelligence using both linear and nonlinear methods including neural networks 6. 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 tools 2. Principles of the discrete Fourier transform, properties, applications 3. Digital filtering using difference equations and frequency domain analysis 4. Approximation of functions, discrete wavelet transform, basic  definitions, signal decomposition, de-noising, reconstruction 5. 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 processing  Four 2-hour seminar work: 1. Programming in MATLAB, structured data, computer graphics 2. Application of DSP and optimization in pattern recognition 3. Application of DSP in sleep, breathing and motion analysis 4. Colloquium with presentation of selected case studies  Excursions: 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 2018 |
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