

COURSE DESCRIPTION

Course name	Wavelets – an introduction
Course type	reading course (wrd)
Supervisor	Anna Kamont
ECTS credit allocation	4 – IM PAN Ph. D. program; 6 - recommended for MA programs
Duration	One semester
Number of hours	30
Language	English or Polish, if every participant speaks Polish
Prerequisites	Mathematical analysis, functional analysis, Fourier analysis, as required for Master's degree in mathematics
Course content	<p>The aim of the course is to present basic results in wavelet analysis. In particular, the following topics are discussed:</p> <ol style="list-style-type: none"> 1. Basic definitions: multiresolution analysis (MRA), scaling functions and MRA wavelets 2. Important examples of MRA and wavelets: Haar wavelet, Franklin-Strömberg wavelet, spline wavelets of higher order; Daubechies wavelets, Meyer wavelets; examples of non-MRA wavelets. 3. Wavelet expansions of functions from $L^p(\mathbb{R}^n)$, $1 \leq p < \infty$ and $C(\mathbb{R}^n)$: convergence in norm and almost everywhere, unconditional convergence in $L^p(\mathbb{R}^n)$, $1 < p < \infty$. 4. Wavelets as greedy bases in $L^p(\mathbb{R}^n)$, $1 < p < \infty$. 5. Wavelet expansions of functions from Sobolev spaces, Hölder functions and functions from Besov spaces.
Recommended reading	<ol style="list-style-type: none"> 1. E. Hernandez, G. Weiss, First Course on Wavelets. Studies in Advanced Mathematics. CRC Press, Boca Raton, FL, 1996 2. Y. Meyer, Wavelets and operators. Cambridge Studies in Advanced Mathematics, 37. Cambridge University Press, Cambridge, 1992. 3. P. Wojtaszczyk, A Mathematical Introduction to Wavelets. Cambridge University Press, Cambridge, 1997. 4. V. N. Temlyakov, Greedy approximation. Cambridge Monographs on Applied and Computational Mathematics, 20. Cambridge University Press, Cambridge, 2011
Learning outcomes	The student should know basic results in wavelet analysis, as listed in „Course content”, as well as methods of their proofs. The student should be prepared to study more advanced

	topics in wavelet analysis, as well as its applications.
Assessment methods and criteria	Lists of exercises and exam
Remarks	Mathematical Institute Polish Academy of Sciences, Branch in Gdańsk