Introduction to Time-Frequency Analysis and Wavelet Transforms - Video course

NPTEL

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Chemical Engineering

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COURSE OUTLINE

The course covers topics on basic definitions and concepts,fourier series and transform (continuous and discrete),basic concept and definition of TFA,duration bandwidth principle,general properties,interference and pseudo WVD,definition and interpretation of CWT,scaling function,frame theory of quick round up and handling boundary effects.

COURSE DETAIL

Week No.	Topics
1	• Introduction – Part I • Introduction – Part II • Basic Definitions and Concepts - I • Basic Definitions and Concepts - II
2	• Continuous-Time Fourier Series • Continuous-Time Fourier Transform • Discrete-Time Fourier Series • Discrete-Time Fourier Transform • Discrete Fourier Transform & Periodogram
3	• TFA: Basic Concepts & Definition • Bandwidth Equation • Instantaneous Frequency • Analytic Signals • Multicomponent Signals
4	• Duration-Bandwidth Principle • Joint Energy Density • STFT: Definition and Interpretations • General Properties - I
5	• General Properties - II • STFT: Application • WVD: Definition and Interpretations • Properties of WVD
6	• Interference and Pseudo WVD • Cohen's class: Brief Review • Connections with Spectrogram • WVD: Application

7	• CWT: Definition and Interpretations • Wavelets • TFA and Filtering Perspective • Scalogram
8	• Scaling Function • Practical Aspects • Wavelet Maxima and Ridges • CWT: Application • DWT: Definition and Interpretations
9	• Frame Theory: Quick Round-up • Multiresolution Approximation • Orthonormal Bases and Conjugate Mirror Filters • DWT Implementation: Pyramidal Algorithm • Choosing a Wavelet
10	• Handling Boundary Effects • De-noising & Signal Estimation – Part I • De-noising & Signal Estimation – Part II • DWT: Application • Closing Remarks