Scientific Computing
Lecture 5

Exam Questions

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Questions

- Give the definition of convolution. Explain its meaning in terms of point spread function.
- Write the generalized form of an integral transform; describe its parts.
- Why do we use the integral transforms? What are we expecting of usage of them?
- Explain the differences of real domain and reciprocal (frequency) domain.
- What is the convolution theorem? Describe why this property is useful.
- How do we use Fourier transform for calculation of correlation of two functions?
- What is Parseval's theorem?
- How the derivatives of some function could be explained with its Fourier image?
- Explain the sampling theorems meaning without formulas.
- What is Discrete Fourier Transform and how is it connected to continuous FT?
- What is the main idea of the Fast Fourier Transform?
- Why FT is that important? List the applications of FFT.
- Describe without mathematical definition: how can we get the Radon transform?
- In terms of the Radon Transform, why to have three projections is better than have only one projection? Justify your answer.
- List the application of the Radon Transform.
- Draw the RT of a point placed at the origin of the coordinates; justify the picture. What will happen if we move the point from the origin?
- With the example of 2×2 image, explain the Algebraic Reconstruction Technique (ART). Which advantages and disadvantages does it have?
- Explain the Fourier Slice Theorem.
- How the FST can be used for inversion of the Radon Transform? Explain briefly.
- Why do we need to study wavelets? Which advantages the wavelets transform has in comparison with Fourier Transform?

Questions

- Write the generalized form of the integral equation. Explain all its parts.
- Write the generalized form of the integral equation. What are equations of the first kind? What are equations of the second kind? Which of them are commonly ill-posed?
- Write the generalized form of the integral equation. What is homogeneous and heterogeneous integral equations?
- Classify the integral equation in terms of Volterra and Fredholm integral equations.
- When the deconovolution (inverse convolution) is ill-posed problem? Justify your answer.