Short Term Course on
Matrix Computations and its application to systems, signal and control problems.

Department of Mathematics, IIT Indore
February 16-21, 2021

About Department

In view of exchanging mathematical ideas, IIT Indore started the Department of Mathematics in July 2009. The Department is expanding both in size and variety of expertise, and has already started Ph.D. Programme and M.Sc. programme in Mathematics. As and when sufficient expertise in fields such as statistics, applied computing and informatics become available, the Department also envisages another programme with M.Sc. degree in these subjects which will be especially suitable for the needs of industry. Please visit http://math.iiti.ac.in for more details.

Important Dates

- This QIP Course will be on online mode.
- Google Meet link will be provided to the registered participants by email before the course starts.

Course Organized By

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Registration Fees

AICTE Colleges:
No fee*(for faculty members)

* The nominations along with the registration forms must be sent through their coordinator/head to mcscp@iiti.ac.in.

Non-AICTE Colleges:
Rs. 2,000/-per faculty/researcher**

For industry participants:
Rs. 5,000/-per participant**

**Evidence of payment should be emailed in advance to confirm the participation.

Overview

The course provides knowledge and understanding of matrix computations in various applications. For this, deeper knowledge of theory, methods, algorithms and software is required for different classes of numerical linear algebra problems. Among other things, the course discusses projections, fundamental subspaces, transformations, orthogonality and angles, rank, matrix factors (eg LU, QR, SVD), condition numbers (ill-posed or well-posed problems), direct and iterative methods to solve linear systems of eigenvalue problems, canonical forms using DFT, FFT, for circulent and Hankel matrices in signals, and related problems involving in control and systems.

Benefit to Teachers?

It is necessary to bring different topics from the undergraduate curriculum and introduce students and faculty to a developing area in mathematics. Basic wavelet theory is a natural topic of this course. The great success of wavelets and shearlet mostly lies in their many desired properties such as multiscale structure, sparse representation, efficient approximation schemes, good time-frequency localization, and fast computational algorithms. In comparison to traditional wavelets, shearlet have the desired properties of redundancy for robustness and flexibility for an adaptive custom design.

This allows the Teachers to become aware what are the current frontiers of wavelet theory and what are the possible further developments and applications of wavelets and framelets. The participants' knowledge about the course content will be raised to the level such that they will be able to use wavelets and shearlets for their own applications and research.

Topics to be covered

- Numerical Algorithm for soloving inverse eigenvalue problems arsing in control
- Computing Eigenelements of Sturm-Liouville problems using Haar wavelets
- Computation of eigenvalues and solutions of regular SturmâĂŞLiouville problems using Haar wavelets
- Solving system of linear differential equations using haar wavelet
- The condition number of matrix
- Characterization of the Haar wavelet matrix by their linear transformation and proved some theorems on properties of Haar wavelet matrix
- Circulant matrices are important because they are diagonalized by a discrete Fourier transform, and hence linear transformationÂăthat contain them may be quickly solved using a FFTÂă.
- Discrete Fourier transform & Fast Fourier transform & Convolution
- Properties of wavelet (Haar, Shannon, Daubechies, etc.)
- Subdivision operator & Pseudo inverse of a matrix
- Low pass filter, high pass filter, p-stage-decomposition, etc. in signal and image processing
- Approximation and Details space
- Solution of differential and integral equation using wavelets (Haar, Daubechies)

For more information

Please visit the link below for recent updates:

http://www.iiti.ac.in/people/~safique/QIP-Matrix-Computation.html