

LINEAR ALGEBRA AND ITS APPLICATIONS

TEQIP-III, TECHNICAL EDUCATION QUALITY IMPROVEMENT PROGRAMME
DEC 16-20, 2020, DEPARTMENT OF MATHEMATICS, IIT DELHI



Government of India
Ministry of Human Resource
Development



COURSE OVERVIEW

This is a five-day workshop on Linear Algebra and Its Applications with hands-on sessions on MATLAB for using computational tools in Linear Algebra. The course will provide an overview of basics of Linear Algebra with focus on applications to Cryptography, Graph theory, Genetics, Data compression, etc.

Each day program will consist of 3 hour lectures before lunch, a two hour lectures/ computer lab session post lunch. Lab sessions will be conducted using Matlab/ Octave.

OTHER INFORMATION

Programme Highlights:

1. This course is aimed at teaching various linear algebra techniques with a strong emphasis on engineering applications.
2. The salient feature of this course is the implementation of various engineering problems using computational Linear Algebra tools.
3. Participants will have hands on sessions on MATLAB programming.

Target Audience:

1. Faculty members of engineering and science departments at TEQIP-III institutes.
2. Participation from outside the TEQIP-III institutes is not permitted in this course.

LIST OF SPEAKERS

List of Speakers:

- Dr. Surjeet Kour (IIT Delhi)
- Dr. Ritumoni Sarma (IIT Delhi)
- Dr. Punit Sharma (IIT Delhi)
- Dr. Abhishek Banerjee (IISc)

Course Coordinator:

Dr. Surjeet Kour
Department of Mathematics
IIT Delhi, hauz Khas,
New Delhi.

LINK/CONTACT INFO

Hard deadline for application is Nov 30. Selected participants will be informed (via email) by Dec 5.
Email: algbra.iitd@gmail.com
Phone: 01126591394
Registration Link:
<https://forms.gle/6rJJj6obm62UKozg7>

TOPICS COVERED/ APPLICATIONS

Topics:

Linear transformation, Eigen vectors and Eigen values, Canonical forms: Diagonalization, Triangulation, Primary decomposition, Eigen values of Special matrices, Spectral Theorem, Singular Value Decomposition, Least Squares Approximation.

Applications:

1) Page Rank: PageRank is an algorithm used by Google Search to rank web pages in their search engine.

2) Cryptography: Cryptography is the study of encoding and decoding secret messages. One of the simpler encoding methods uses matrix transformations and modular arithmetic to encode/decode messages. These codes are called Linear Codes:

3) Graph Theory: Adjacency matrix of a graph and its component are used in many real world applications like; path efficiency, network redundancy and ranking predictions.

4) Least Squares Approximations with Application to Power Systems:

5) Singular Value Decomposition with Applications to Industrial Data Analysis

6) Genetics: Genetics is the study of inheritance. Linear Algebra can be used to look at the ideas behind recessive and dominant traits and determine how a trait will be distributed in future generations.



Page Ranking

Google uses page ranking algorithm which has also been dubbed as the "\$25,000,000,000 (\$25B) Eigenvector"

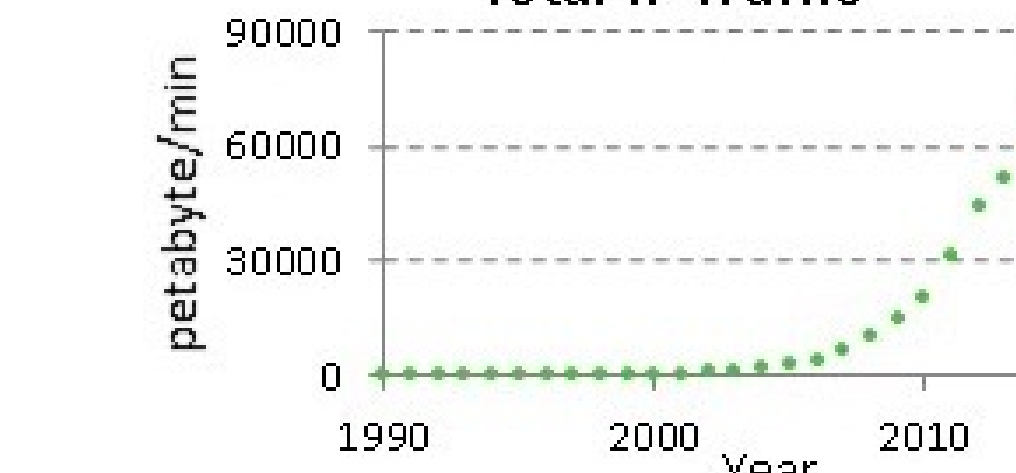


Data compression

Theorems in linear algebra are heavily used for data compression without losing the essence of information.



Total IP Traffic

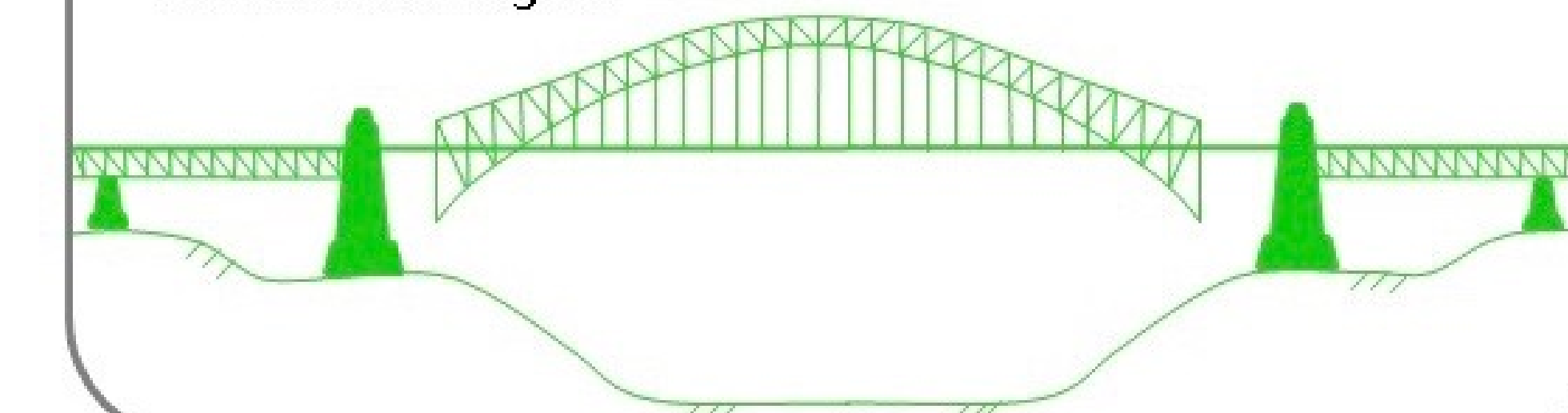


Data transfer

Linear algebra finds application in Error correction and encryption.

Engineering

Computational mechanics extensively utilizes tools developed in Linear Algebra. It is used in designing from brakes to bridges.



Genetics

Markov chain is a mathematical model which depends on the probabilities, and is very useful in solving problems in genetics.