

Syllabus

Spring 2024 MATH 625 / CSI 740

Numerical Linear Algebra

Schedule: W 7:20-10 pm, Exploratory Hall 4106. There is no class on March 6

Instructor: Igor Griva, igriva@gmu.edu, (703) 993-4511

Office hours: W 10 – 11 pm, Exploratory Hall, Rm 4114

Recommended Prerequisite: Knowledge of Linear Algebra, Computer literacy, including some experience with Matlab.

Text: “Numerical Linear Algebra” by Trefethen and Bau, SIAM, 1997

Exams: There is one midterm exam: March 27 (points 0 - 100)

Final Exam: May 1 (points 0 - 100)

Final score: $F = 0.3*(\text{Midterm}) + 0.4*(\text{Homework}) + 0.3*(\text{Final Exam})$

General description:

The course surveys theory and development of numerical algorithms for solving linear systems of equations, including direct and iterative methods; analysis of sensitivity of system to computer round off; and solution of least squares problems using orthogonal matrices. Also covers computation of eigenvalues and eigenvectors, singular value decomposition, and applications.

Additional reading:

“Matrix Computations” by Gene H. Golub and Charles F. Van Loan, Jpoohn Hopkins, 1996.

“Applied Numerical Linear Algebra” by James W. Demmel, SIAM, 1997

“Linear Algebra and its Applications” by Gilbert Strang, Harcourt Brace Jovanovich, 1988

“A multigrid Tutorial” by William L. Briggs, Van Emden Henson and Steve McCormick, 2nd Edition, SIAM 2000

Topics week by week

Week 1. Review of Matrices and Linear Maps.

Week 2. Singular Value Decomposition.

Week 3. Projectors.

Week 4. Orthogonality, QR factorization.

Week 5. Householder Triangularization, Least Squares.

Week 6. Conditioning.

Week 7. Stability.

Week 8. Spring Break

Week 9. Conditioning and Stability of Least Squares.

Week 10. Gaussian Elimination, Cholesky Factorization, Eigenvalue Problems.

Week 11. Midterm.

Week 12. Simple Eigenvalues algorithms.

Week 13 QR Algorithms for Eigenvalues.

Week 14. Advanced Eigenvalue algorithms, SVD Computation.

Week 15. Iterative Methods, Arnoldi and Lanczos Iterations.

Week 16. Final Exam.

Academic Integrity:

Mason is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

Disability Services:

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474,

<http://ods.gmu.edu>. All academic accommodations must be arranged through the ODS.

Counseling and Psychological Services (CAPS):

(703) 993 2380, <http://caps.gmu.edu>

University Policies:

The University Catalog, <http://catalog.gmu.edu>, is the central resource for university policies affecting student, faculty and staff conduct in university academic affair. Other policies are available at <http://universitypolicy.gmu.edu>.