The George Washington University
Washington, D.C.

ApSc 212 – Analytical Methods in Engineering II (Linear Algebra)

Spring 2010 – Main Campus

Reference: *Linear Algebra and Its Applications*, fourth edition, by Gilbert Strang (Thomson Brooks/Cole, 2006), ISBN 9780030105678.

Notes: *Applications of Linear Algebra* by G.C. Everstine

Instructor: Gordon C. Everstine, `http://gwu.geverstine.com`
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Schedule: Mondays, Jan. 11 – May 3, and Wednesday, April 28 (designated Monday), 6:10 p.m. – 8:40 p.m.
No class: Jan. 18, Feb. 15, Mar. 15
Mid-Term Exam: March 29
Final Exam: May 3

Description: Algebraic methods appropriate to the solution of engineering computational problems; linear vector spaces, matrices, systems of linear equations, eigenvalues and eigenvectors, quadratic forms.

Objectives: To understand algebraic methods used in the solution of engineering computational problems; to apply some of the algorithms discussed by writing simple computer programs; to appreciate some of the issues involved in commercial engineering software.

Grading: Assignments 1/3, mid-term exam 1/3, final exam 1/3. All graded work must be completed in accordance with the GW Code of Academic Integrity (`http://www.gwu.edu/~ntegrity/code.html`). Students are encouraged to discuss the meaning of assignments and general approaches and strategies for handling those assignments, but it is not acceptable to share solutions and computer codes.

Course Outline

1. Systems of linear equations; Gaussian elimination; operation counts; partial pivoting; LU factorization; determinants; iterative methods
2. Vector spaces; rectangular systems; linear independence; pseudoinverses; linear transformations; orthogonality; projections
3. Change of basis; index notation and tensors; examples
4. Least squares problems; fitting; Gram-Schmidt orthogonalization; QR factorization
5. Fourier series; generalized Fourier series; expansions using polynomial basis
6. Eigenvalue problems; applications to dynamical systems; properties; orthogonality; power iteration; similarity transformations; positive definite matrices; applications to structural dynamics and differential equations